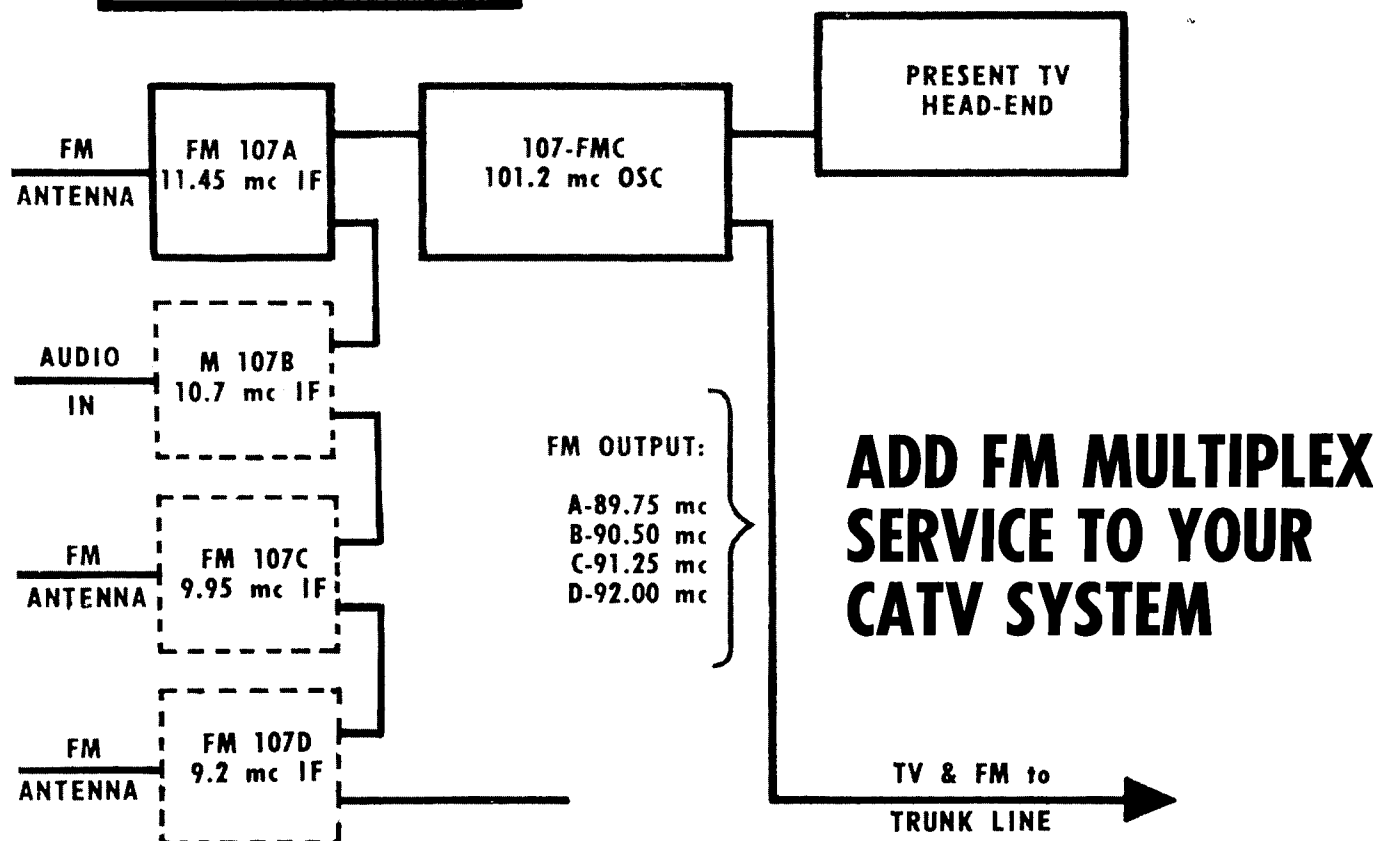


**APR.
1962**

tv horizons



The Professional Television Journal

IN THIS ISSUE

Multi-Plex FM on CATV/MATV • Radical Approach to
CATV in Canada • First Report—NYC UHF Test • Line
Reflections in Wired TV Systems



TWICE THE "CASCADE-ABILITY" OF ANY ALL-BAND AMPLIFIER

NEW
JERROLD®

Model SCA-213

SUPER CASCADER AMPLIFIER

Two years in engineering, the new Jerrold all-band Super Cascader Amplifier is the ideal amplifier for expanding your system to the ultimate in all-band capabilities. The Model SCA-213 is designed for use in new or existing systems wherever maximum "cascade-ability" and reliability in an all-band trunk-line amplifier are prime requirements.

Provides 28 dbj* of gain @ 216 mc, and output of 45 dbj* per channel for seven channels at a cross-modulation distortion of only 0.14%. The Super Cascader has been meticulously engineered to provide long-life, trouble-free, economical service. Write for complete technical data.

*0 dbj=1,000 microvolts across 75 ohms.

F E A T U R E S

- MAXIMUM "CASCADE-ABILITY"
- EXTRA-WIDE BANDWIDTH (6-220 mc)
- PLUG-IN EQUALIZERS COMPENSATE FOR CABLE LOSSES
- FREQUENCY RESPONSE FLAT WITHIN $\pm 1/2$ db WITH EQUALIZATION
- VOLTAGE-STABILIZED TRANSFORMER
- PLUG-IN AGC (Use with Jerrold Model AGC-213)
- LOW NOISE FIGURE
- HIGH OUTPUT CAPABILITY

JERROLD ELECTRONICS CORPORATION

Community Systems Division Dept. IDS-227

MAIN OFFICE:

Philadelphia 32, Pa. • BA 6-3456

WESTERN REGIONAL OFFICE:

1042 Terminal Way, San Carlos, California. • LY 3-8273

Channel

1

Commission's '52 Report/Order-Catastrophe?

FCC Commissioner Robert E. Lee, speaking before Institute of Radio Engineer's Annual Fellows Dinner, Tarrytown, New York on February 16, took to task the Commission's 1952 Report and Order, which ultimately established the present VHF-UHF 82 channel television system in the United States. Lee noted "... I did not participate in the Commission's Report and Order of 1952, but I would be no less critical than I am today were I to have been solely responsible for its errors. The ancillary tragedies which have occurred since 1952 have caused me to believe that no single decision of the Commission has been so catastrophic.

"When the Commission spurned the advice of industry experts and adopted a television allocations plan intermixing VHF and UHF channel assignments in the same markets, it unwittingly preserved virtually the same television monopoly that existed prior to the television freeze.

"Some 100 UHF television stations came on the air and folded up in financial ruin after losses aggregating an amount which I would estimate to be \$20 million. About 39 UHF stations are continuing in operation with annual operating losses which aggregate \$2 million per year.

"... Basically, the situation has not been considerably improved. The fat cats in television continue to get fatter, the lean ones thinner and the public (is) deprived of competitive television. In 1957 we (the Commission) instituted an allocations proceeding in Docket 11997 to determine the spectrum needs of various segments of the radio users—common carriers, industrial licensees, local governments and the whole gamut of those with needs for radio. It is one thing to listen to the needs of those potential users when there is some hope of satisfying these

CATV MATV Fringe TV ETV UHF-TV Associated Industries' News

needs. However, it is quite frustrating to have nothing to offer such hungry people.

"We at the Commission are being flooded with letters, resolutions, and petitions urging that we do not take away the only VHF service from the areas which we propose to deintermix. Since these communications are, for the most part, identically worded, it is easy to see that the prosperous few are beating the bushes. So many of the public are being told that they are going to lose their only television service that I have been prompted to answer a few written personally to me (the UHF ogre!) I feel that if the situation is not corrected, the UHF stations now hanging on through dire financial straits will be bankrupted. As a result, the public's choice of programs by and large could be reduced from three (one VHF and two UHF stations) to one—a nice fat VHF station which can only carry one program at a time and hence one network at a time. Thus the listener could no longer have a choice between NBC, CBS, and ABC. Rather, the remaining station would have (in his power) the choice of which program to carry.

It is all apparent that it would choose the program most remunerative. How would the public be served by such a turn of events? I leave the answer to you."

DE-INTERMIXTURE DEADLINE SET BACK 3 MONTHS

The Commission, on March 7, announced it was setting back until June 23 the previous deadline of March 23 for the filing reply comments in the proceedings currently underway to remove single VHF telecasters in 8 of the nation's larger cities.

All 8 areas have been scenes of bitter local debate and the cause of considerable congressional pressure placed on the Commission.

CATV OPERATOR WOULD APPLY FOR CHANNEL 15

William J. Calsam, operator of Oneonta Video and President of Craftsman Electronics (CATV products manufacturing firm), Oneonta, New York, has been successful in his bid to have channel 15, originally assigned to Rochester, N.Y., shifted to Oneonta. Calsam, in petitioning the Commission, stated he intends to apply for channel 15 in Oneonta. Oneonta Video began closed circuit local origination on a regular basis in June of 1961. Calsam is currently expanding his CATV operation to include microwave programming from New York City telecasters.

KATONA ELECTED VP AT CRAFTSMAN

Anthony S. Katona, formerly Administrative Assistant to Community Systems Division Manager at Jerrold Electronics, Philadelphia, has been added to the growing team at Craftsman Electronics, Oneonta, New York. Katona is the new Vice President in charge of sales and engineering for Craftsman. The Craftsman line is being expanded to include a complete line of amplifiers, distribution units, fittings, transformers, splitters and cable.

TELEVISION HORIZONS

PUBLISHED MONTHLY BY HORIZONS PUBLICATIONS
Post Office Box 1557 • Oklahoma City 1, Oklahoma

EDITORIAL

Many of us tend to live within a shell that not only 'protects' us from the outside world, but also shields us from the knowledge of others. For example, we recently were allowed to share in a tabulation of CATV systems in Great Britain and Ireland (these did not include the continent of Europe). we were surprised to see that by USA standards, nearly 2700 CATV systems exist in the U.K.! That's double the number in the United States, and it represents a land area smaller than the state of Texas.

Just as recently we spent nearly an hour on the telephone with a gentleman calling from Guatemala City, Guatemala, C. A. whose interest in CATV stemmed from his nation's limited number of broadcasting stations, and un-limited number of mountain shielded valley towns. In this case the local broadcasters have tentatively decided to go ahead with a program of CATV equipment installation as a joint owned and operated project. The stations, which derive little income from advertising, hope to be able to justify their existence by selling their signals on CATV to outlying areas. Not a new approach, but a novel one.

Finally, from Canada this month, a very interesting look into wired television in Canada by Mr. I. Switzer of Estevan, Saskatchewan. This month's first installment by Mr. Switzer details the reasons for Canadian CATV acceptance. Next month's equally timely and interesting part two of this series will approach Canadian CATV from an engineering standpoint. We believe you will be intrigued to learn what it takes to put CATV across outside the USA, and the methods employed by such capable operators as Switzer in providing the service.

TABLE OF CONTENTS

FEATURES

FM STEREO FOR CATV/MATV	
Profit or Problem?.....	4
FCC RELEASES PRELIMINARY DATA	
First Report on New York UHF Channel 31 Test.....	8
CANADIAN CATV OPERATORS SAY "Vive la Difference!"	
I. Switzer, Co-Ax TV Ltd., Estevan, Saskatchewan.....	10
REFLECTIONS IN CATV TRANSMISSION LINES	
Jacob Shekel, Spencer Kennedy Labs, Boston, Massachusetts.....	15

DEPARTMENTS

Late News of the Industry	
CHANNEL ONE.....	1
Foreign CATV Markets	
EDITORIAL	2
CATV Across the Atlantic	
OUR MAN IN EUROPE, Gordon J. King.....	17
News of the Wired TV World	
CABLE DROP.....	22
On Vacation This Month	
FCC BRIEFS	
DEPT. JJ	
PR IN CATV	
FIELD ENGINEERING	

STAFF

R. B. Cooper, Jr., W5KHT
Publisher-Editor

Jim Kyle, K5JKX
Managing Editor

Carlyne Silva
Associate Editor

Les Farey
Lon Cantor
Charles Wigutow
Marv Mitchell
Vic Nicholson
Contributing Editors

Gordon J. King
"Our Man In Europe"

Jackie Johnson
Business Manager
Stanley M. Searle
Art Director

Bonnie Fanter
Circulation Manager

EDITORIAL OFFICES
4 NW 7th Street
Oklahoma City, Oklahoma
Central 2-1108

BUSINESS OFFICES
1518-9th Street
Modesto, California
U.S.A.
LAmbert 4-7395

ADVERTISING: Television Horizons accepts commercial display advertising from bona fide manufacturers of electronics equipment and apparatus dealing with the CATV, MATV, fringe-TV, ETV and rebroadcast TV industries. Advertising rate card and circulation data upon request.

CIRCULATION: Television Horizons is circulated through the mails and in person on the 5th of each month to an average of 7,500 readers in the CATV, MATV, TV servicing, fringe-TV, ETV and TV broadcast (and rebroadcast) industries. Circulation is both paid and controlled. Detailed circulation breakdown, by reader occupation, is available upon request.

SUBSCRIPTION: Subscription rates in the United States and Canada \$5.00 per year. Subscription includes the Annual Directory edition, issued every December. Single magazine copies \$.50 each. Single Directory Editions \$1.00 each. Subscription remittances should be made by bank money order or check. Two year subscription rate U.S.A. and Canada—\$8.00. Subscriptions outside the U.S.A., Canada \$6.00 per year.

TELEVISION HORIZONS (title registered U.S. Post Office) entered as second class postage material December 30, 1960. Second Class Postage Paid at Oklahoma City, Okla. All rights reserved. Address of publisher in Oklahoma City is 4 NW 7th Street.

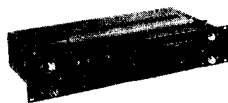
CATV IS GOING WIDE BAND ... SKL IS LEADING THE WAY!

As more and more CATV owners make the *wide band* decision for the construction of new systems and the conversion of old ones, they turn to SKL for equipment and engineering with *experience*.

First in the wide band field, SKL pioneered the all-channel CATV system a decade ago. Since then, thousands of SKL wide band distributed amplifiers and their associated equipment — over many millions of actual operating hours — have demonstrated their high fidelity performance, their continuing reliability, their low maintenance cost year after year.

They have built SKL's solid reputation for top quality. They have proved that in *every* way, SKL is *first* in wide band systems.

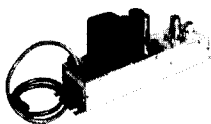
Just a Few of SKL's Wide Band "Firsts":



1950
First wide band distributed main line amplifier.



1951
First wide band directional coupler.



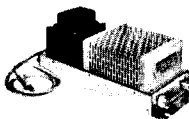
1952
First automatic level control unit for wide band systems.



1954
First Multivider line splitter for wide band use.



1956
First Chromatap line tap for wide band application.



1958
First wide band distributed feeder line amplifier.



1959
First "Thermatic" gain control for wide band systems.



1960
First "Thermatic" wide band line equalizer.

... And in **1961**, the *first* high gain, thermally controlled *wide band* distributed main line amplifier, which remains the standard of the industry.

For the most advanced wide band equipment — backed by the most experienced engineering — call the leader in the field. Call SKL *first*!

SKL SPENCER-KENNEDY
LABORATORIES, INC.
1320 SOLDIERS FIELD ROAD
BOSTON 35, MASS.



FM Stereo For CATV/MATV

PROFIT OR PROBLEM?

Like it or not, FM Stereo Multiplex is apparently here to stay. For many CATV systems, this new service offers the possibility of additional revenue—but it brings with it a number of new technical problems.

Even though off-the-air FM reception may be possible in your area, FM Stereo still offers revenue possibilities. Like color TV, FM Stereo requires a much stronger and cleaner signal at the set than is required by the older forms of transmission. CATV systems can provide the necessary signal.

Aside from the technical problems—which have been worked out by at least one manufacturer—the only apparent drawback to a CATV system offering FM Stereo as an added service is the fact that some joint construction contracts with telephone systems prohibit the addition of FM service. All indications are that these restrictions are being eased, due primarily to the work of the NCTA pole line committees.

Introduction of FM Stereo to a CATV system also offers the possibility of providing background music for business and professional subscribers, since much of the equipment used to provide FM Stereo to the trunk line is also capable of handling additional channels.

If this is done, the operator faces no extra technical problems but a few administrative dragons rear their heads. The most important is that arrangements must be made with ASCAP and BMI for payment of royalties for use of the music. These royalties usually amount to between $\frac{1}{2}$ to $5\frac{1}{2}$ percent of the total subscriber billing.

The necessity for royalty payment is usually more than offset by the additional revenue obtainable from the background-music service. In fact, it's even possible (as a number of FM broadcasters have proved) to make a background-music service support all the rest of the operation.

Because of the problems encountered in initial attempts to add FM Stereo to CATV systems, the NCTA asked several members for comments and suggestions. One of the most practical methods of adding FM Stereo to a system was that suggested by Kip Fletcher, operations manager of Systems Management Company, Pottsville, Pa. A system similar to Fletcher's was independently developed a year earlier and is being offered by CAS Manufacturing Co., Mineral Wells, Texas.

Before we examine the details of this system, let's review existing techniques for putting an FM channel or two into a CATV system. Basically, three techniques are in use.

If your amplifier chain is an "all band" type, with bandpass from 54 to 220 mc., you probably merely pick up the existing FM channel and amplify it without processing. In this case—and this case only—you will have no problems with FM Stereo, since you do not process the signal in any way except to amplify it.

A more common system is the "low band plus" variety, which covers the range from 54 to 95 mc. This includes part of the FM band but not all. In this system, FM stations whose assigned channels fall within the system bandpass range are handled in the same manner as in an "all band" system, but FM stations whose frequencies are higher than 95 mc. must be treated in the manner used in a "low band only" system.

The "low band only" system, with a bandpass of 54 to 88 mc., includes no part of the regular FM band. In this system, FM stations must be moved from the 88-108 mc. band to a lower frequency. They may be put in place of a vacant TV channel, or in the 72-76 mc "guard band" between channels 4 and 5.

Two techniques are in use for moving the FM signal. Possibly

the most common method is to receive the FM signal off-the-air with a conventional or special tuner, recover the audio signal, and then use this audio signal to modulate a low-power FM transmitter whose frequency is placed at the desired spot and whose output is fed into the amplifier chain along with the TV signals. This technique is *not usable* for FM Stereo!

Less commonly used is a double-conversion technique similar to that used to move a UHF or high-band TV signal to a low-band channel. In this technique, the FM signal is received off-the-air as before but is not demodulated. Instead, the intermediate-frequency signal of the FM tuner is then converted to the desired output frequency in a mixer stage, and the output applied to the CATV trunk line.

This double-conversion technique is the one recommended. Fletcher suggests that existing FM modulator equipment can be modified to accomplish this, by bypassing the audio stages in both the demodulator and modulator units.

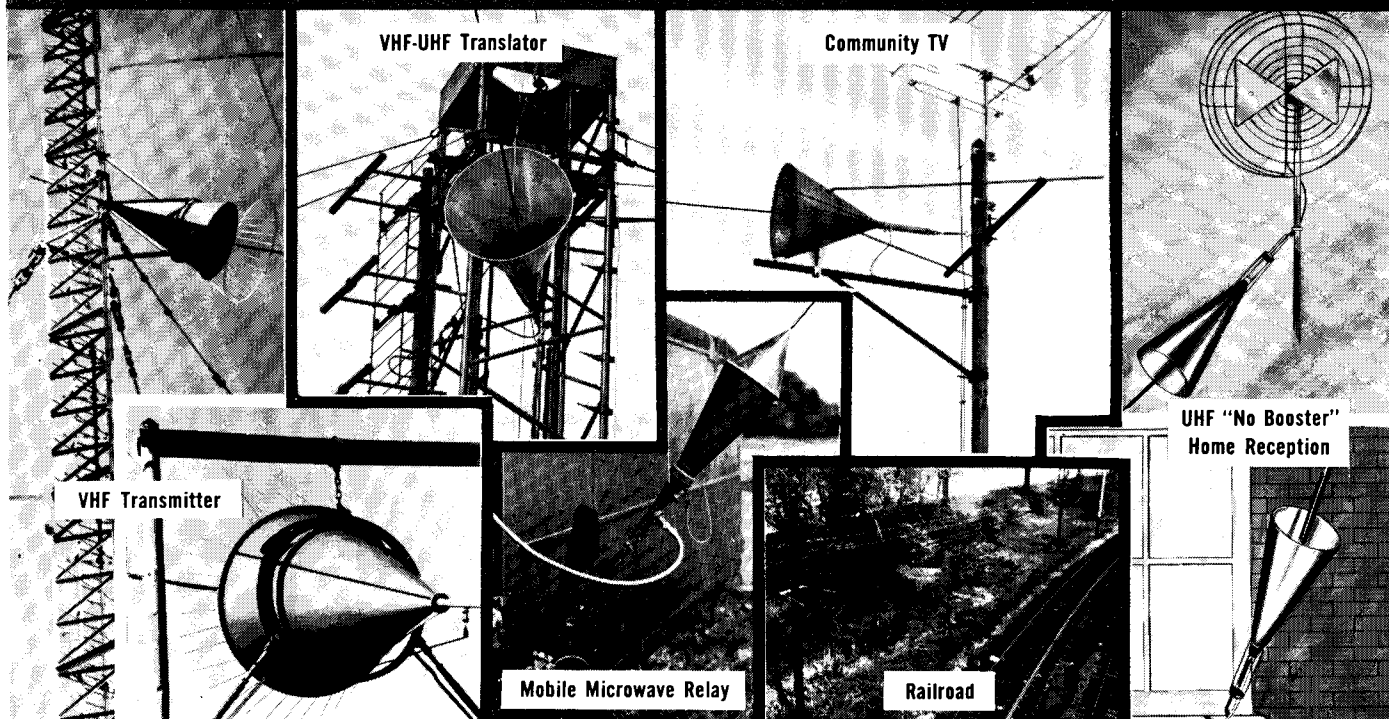
In the CAS system, incoming FM Stereo signals are picked up and converted to an IF in the neighborhood of 10.7 mc. by a crystal-controlled tuner. A separate tuner is necessary for each FM channel to be received. The outputs of all the tuners in use are then applied to a crystal-controlled up-converter which simultaneously converts as many as four channels to the desired output frequencies.

With this system, and optional accessories, the CATV operator can inject his own locally originated program material as well as off-the-air material.

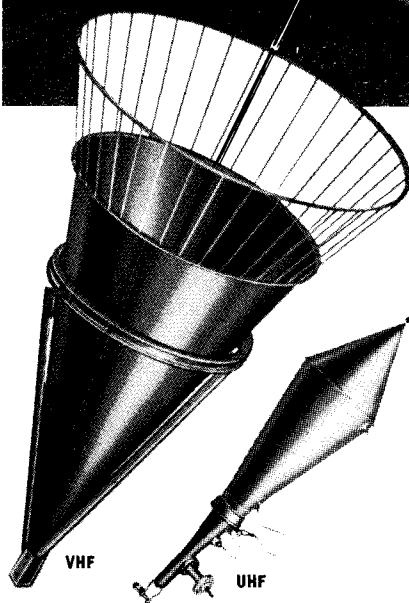
For instance, a typical CAS system for FM Stereo and local pick-up might include two model FM-107(*) tuners (the asterisk indicates a letter suffix; in this example one tuner would be an "A" model and one a "B"); one model M-107(*) modulator (a "C" model in the

"G-Line" TRANSMISSION LINE

LOW-LOSS • BROAD BAND • LIGHT WEIGHT



CONDUCTORS FOR G-LINE SYSTEMS



HIGH POWER LAUNCHERS OR RECEIVERS

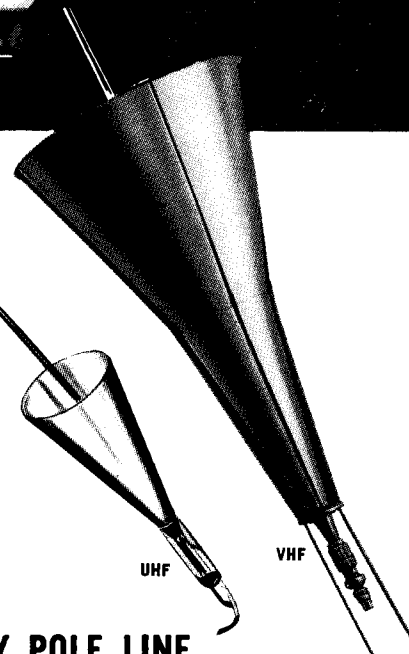
- RF Feeder Lines
- Transmitters
- Translators
- Microwave Relays
- Mobile Radios

MICROWAVE BY WIRE

LOW POWER LAUNCHERS OR RECEIVERS

- Closed Circuit (Community) TV
- Home Reception & Educational TV
- Railroad Communication & Signaling
- Industrial TV & Supervisory Systems
- Vehicular Communication & Control

MICROWAVE BY POLE LINE



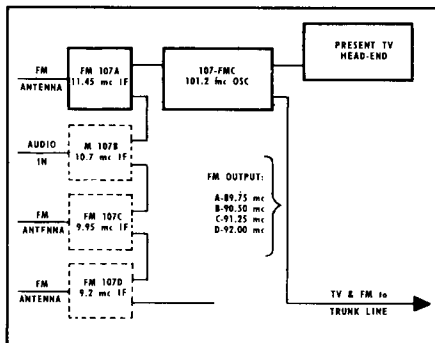
"G-Line" SURFACE CONDUCTION INC., 1501 Broadway, New York 36, N. Y.

example); and one model 107-FMC up-converter.

With this installation, two separate (Stereo) FM channels would be received. The FM-107(A) tuner would convert its incoming FM signal to an intermediate frequency of 11.45 mc; the (B) tuner's output would be at 10.7 mc; and the (C) modulator would convert incoming audio signals from mikes, tapes, or discs to an FM signal at 9.95 mc. These three IF frequencies, applied to the 107-FMC up-converter using a 84.45 mc. crystal, would produce three output frequencies at 73, 73.75, and 74.5—all within the guard band between channels 4 and 5.

For a "low band plus" system, it would be better to put the FM Stereo signals into the lower half of the regular FM band rather than into the guard band. For instance, a 101.2 mc. crystal will produce output signals at 89.75, 90.5, and 91.25 mc. In either case, the output of the 107-FMC would be added to the output of the present TV head-end and fed to the trunk line.

With the double conversion system, many arrangements are possible. In the CAS approach, for instance, you could use FM-45(*) tuners to get 4.5 mc. output instead of 10.7 mc., and then apply this to a TV-M(*) unit to put an FM station onto a vacant TV channel. This would make FM available to subscribers who do not own FM



receivers—but this approach is not, as such, applicable to FM Stereo.

Fletcher suggests that an alternative method for providing FM Stereo service might consist of using a stereo tuner at the head end, separating the stereo channels out, then putting the two stereo channels on the trunk at separate frequencies so that subscribers need not own FM Stereo equipment. This could be done in the CAS system by putting one stereo channel onto a vacant TV channel as described above, and by putting the other stereo channel into either the guard band or the low end of the regular FM band as described earlier for locally originated material. Then subscribers could receive one channel of the stereo information through their standard FM receiver, and the other through their TV set. This feature might provide added incentive for residents to subscribe; whether the incentive would overbalance the

additional equipment investment required could be determined only by local evaluation of the situation.

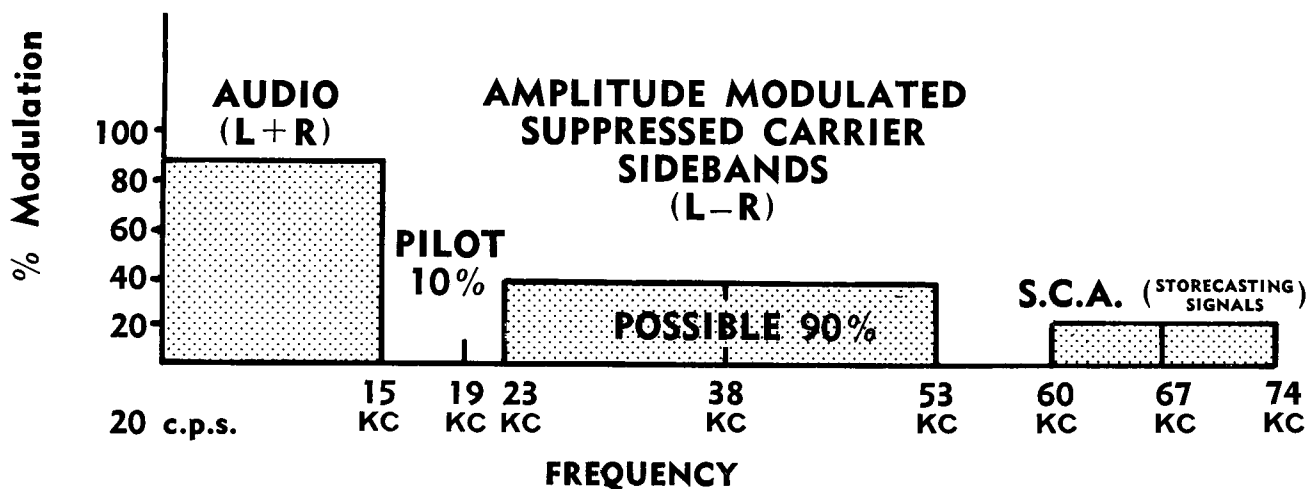
The double-conversion technique is ideally suited to microwave links, and CAS produces a special line of equipment designed with this application in mind. At least two such installations are known to be in operation at the present time: one is a single-hop link at Brownwood, Texas, and the other is a pool arrangement in Wyoming in which several CATV operators have joined forces to operate a microwave link on a longer haul. Both of these installations are now carrying FM Stereo program material.

FM Stereo, even with the double-conversion system, will still present technical problems not present in conventional FM or TV signals.

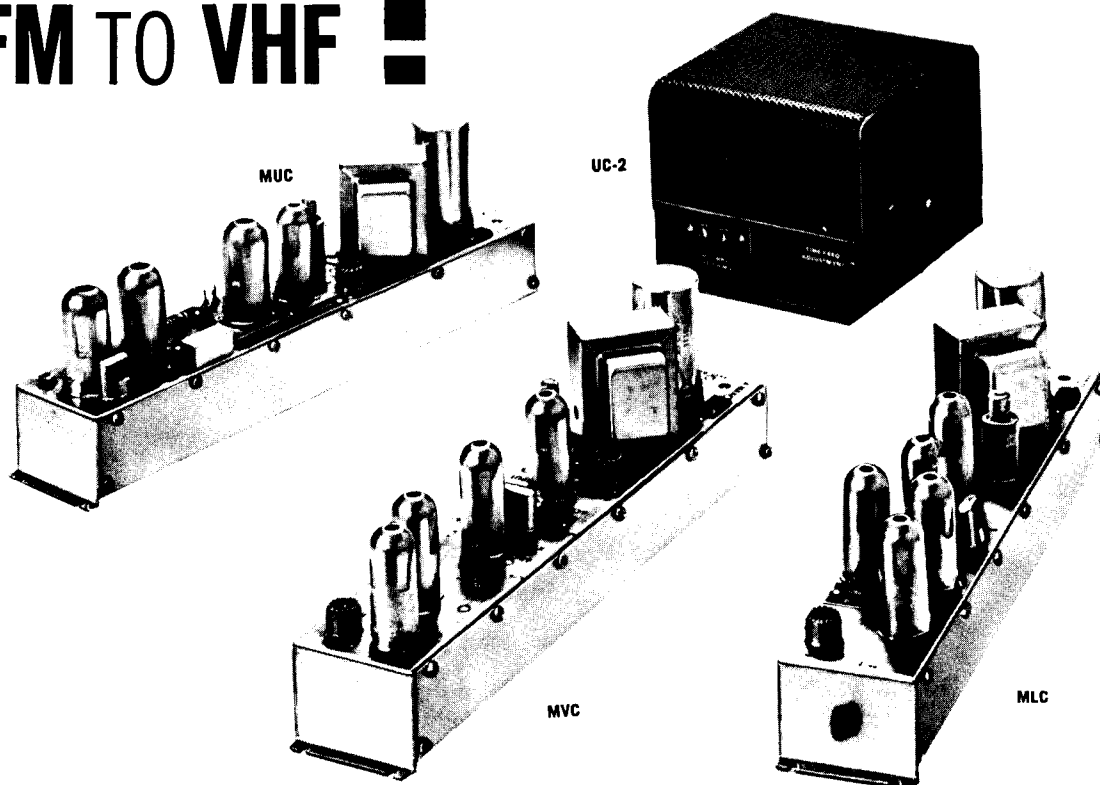
Fletcher points out that the handling of FM Stereo signals will be substantially more delicate than that of the standard FM signal. There are two primary reasons: Drift in a tuned circuit can strip the 39-kc stereo-difference component from the FM Stereo signal, and non-linear distortion in any of the equipment (which would not affect a conventional FM signal) can result in cross-talk between the stereo channels.

Futhermore, Fletcher adds, since the phase relationship between the components of the FM
(Continued — Page 21)

DISCRIMINATOR OUTPUT



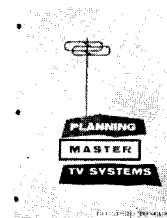
UHF TO VHF VHF TO VHF FM TO VHF ?



select the converter to do the job best from the world's only matched and integrated line

BLONDER-TONGUE UHF & VHF CONVERTER-AMPLIFIERS FOR MATV, CATV, CCTV, ETV

MODEL	DESCRIPTION	GAIN	IMPEDANCE INPUT	IMPEDANCE OUTPUT	FEATURES	LIST
UC-2	UHF to VHF converter	6db to 10db	300 ohms	75 ohms	Built-in dual output mixing network.	165.00
MUC	UHF to VHF converter	15db to 30db	300 ohms	75 ohms	Crystal controlled. Dual output mixing network.	387.50
CO-3 (not illus.)	UHF to VHF converter	1db to 5db	75 ohms	75 ohms	Crystal controlled. UHF pre-amp	558.00
UNIVERter (not illus.)	VHF to VHF converter	—	75 ohms	75 ohms	requires external power supply	143.25
MLC	Lo to Lo VHF converter	20db to 40db	75 ohms	75 ohms	Crystal controlled. Dual output mixing network.	400.00
MVC	HI to Lo VHF converter	33db	75 ohms	75 ohms	Crystal controlled. Dual output mixing network.	400.00
CO-2 (not illus.)	VHF & sub channel converter	up to 20db	75 ohms	75 ohms	Crystal controlled. (FM to VHF available, list 615.00.)	403.00



Today, contact your Blonder-Tongue distributor. Write for Free 28 page planning and installation manual. Free layout service. Also, engineering service available at cost.

engineered and manufactured by

BLONDER-TONGUE

9 Alling St., Newark, N. J.

Canadian Div.: Benco Television Assoc., Toronto. Export: Rocke Int'l. Corp., N. Y. 16, N. Y.-CABLES:ARLAB
home TV accessories • UHF converters • master TV systems • closed circuit TV systems

FCC RELEASES PRELIMINARY DATA . . .

FIRST REPORT ON NEW YORK ULTRA HIGH FREQUENCY CHANNEL 31 TEST

Is the old bugaboo of UHF television—the belief that UHF offers inherently poor picture quality—about to be blasted forever from the scene?

According to the first preliminary data obtained in the New York City tests, where the FCC is spending \$2 million to get an accurate, unbiased comparison of UHF and VHF picture quality, no significant inherent difference exists.

Commission engineer George V. Waldo, in releasing the data, cautioned that the figures represent too small a sampling of the planned 5,000 locations to draw meaningful conclusions. "Another group of data may result in entirely different conclusions," said Waldo. "Analysis of the data in further detail will not provide significant results until a much larger number of measurements have been made."

However, during the first four months of the test the UHF signal on channel 31 provided picture quality almost equal to the high-band VHF signal (channel 7) used for comparison, and the channel 31 signal was only slightly behind the low-band channel 2 picture as well.

Specifically, 89 percent of the locations provided a "grade 1" picture, the best obtainable, from the UHF signal. The figure rose to 91 percent for channel 7 and to 94 percent for channel 2.

A "grade 2" picture, showing perceptible degradation but still having high picture quality, was obtainable at 97 percent of the locations on both channels 31 and 7. The percentage rose a point to 98 for channel 2. These figures, naturally, include all locations at which a grade 1 picture was available.

All the locations tested provided a picture quality of grade 3 or better on the two VHF channels, but the percentage fell to 99 for the UHF channel. At the grade 4 level, all channels had the same 100-percent mark. The grade 4 level is the typical "deep-fringe" picture quality.

UHF proved slightly more susceptible to ghosting than did either of the VHF channels, but the ghosts did not seem to be as severe. Channel 7 was most ghost-free, with 77 percent of the locations showing no ghosts at all. On channel 2, the figure dropped to 71 percent, and on UHF, to 69 percent.

However, 94 percent of all locations reported pictures with detectable but non-disturbing ghosting on both UHF and high-band VHF. The figure rose to 96 percent for low-band VHF. In no case did ghosts bring the picture quality below "grade 4" level on any channel.

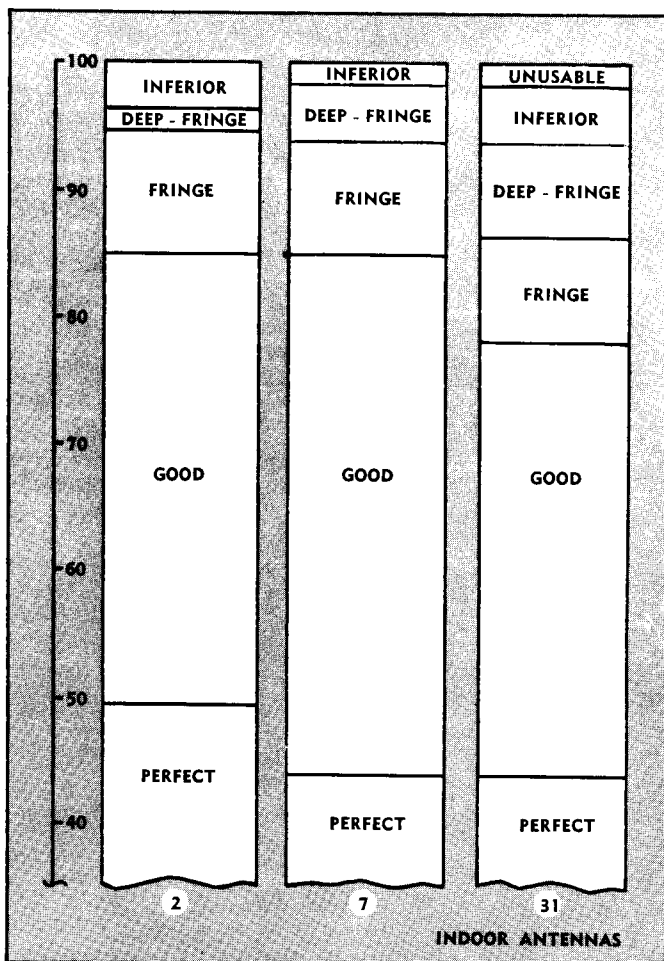
These figures are all based on use of outdoor antennas on all channels. With indoor antennas, channel 31 fared just about the same as channel 7

and both were noticeably inferior to channel 2. Only 43 percent of the locations provided perfect pictures on either 31 or 7, while 49 percent reported perfect pictures on 2.

Grade 4 reception or better was reported at 94 percent of the locations on UHF, compared to 99 percent at channel 7 and 97 percent at channel 2. At one percent of the locations, no usable picture could be obtained indoors on UHF.

"There is a slight difference between VHF and UHF picture quality at the average location," said Waldo, "but this difference is not significant considering the limited amount of sample measurements completed at this time."

Normalized field-strength readings outdoors showed a 6-db loss at channel 31 compared to channel 2; the loss compared to channel 7 was only 4 db. Indoor measurements, again normalized, showed 15 db



lower signal on UHF than on low-band VHF, and 10 db loss between high-band VHF and the UHF transmission.

Despite the favorable comparison—a bulwark to the commission's belief that the UHF region offers the only secure future for TV broadcasting if viewer service can be comparable to that now enjoyed on VHF—Waldo emphasized that no conclusions should be drawn yet.

"The data so far available," he declared, "is not sufficient for estimating the quantity or quality of TV service generally available to the population within the service area of the Empire State Building."

Specifically, the results reported here represent only 200 measurements at 100 locations. The goal of the test is 60,000 measurements at 5,000 locations.

A fair question, at this point, would be, "How is this test being conducted?" Mr. Arnold G. Skrivseth, FCC project chief of the test, has the answers:

The test is comparing channel 31 with channel 2 and channel 7; in addition, colorcasts are being compared on channel 31 and channel 4. The transmitting antenna for the UHF station is mounted atop the Empire State Building, duplicating as closely as possible the location of the VHF antennas. Power of the UHF transmitter is 50 kw.

Reception is being monitored by 100 monochrome table model receivers, spotted at locations within a 25-mile radius of the antenna site. In addition, the measurement crews have 15 more portable monochrome receivers with which they determine picture quality prior to making measurements. Color reception is being checked with 10 color receivers.

All receivers are current production units, al-

though each was specially selected from the production line at the manufacturer's to assure compliance with test specifications.

At some receiving locations, special low noise RF amplifiers are used to simulate the performance of possible future commercial receivers. These amplifiers have a noise figure of 5.5 db at channel 31. All data taken from sets equipped with these amplifiers is being evaluated separately.

Although at any given instant, no more than 125 separate locations can be checked, the experiment is gathering data from 5,000 locations within the test area. These locations were chosen by the probability method, by the Census Bureau, to produce a statistically accurate representation of the entire test area.

Mr. Joseph Steinberg and Mr. Daniel Levine, both of the Census Bureau, explained that the large sample provides a 0.3 percent accuracy; in other words, at the 50 percent level less than 3 out of 1,000 locations would fall outside the range 48 to 52 percent.

The 100 table model receivers will be spotted among 1,000 locations taken from the 5,000-location sample group. Each receiver will be moved once each month to one of 10 locations; thus, all 1,000 locations will be covered at least once during the test at the rate of 100 locations per month. The choice of each subsample was also made by statistical methods.

The other 4,000 locations are being covered by eleven 2-man monitoring-measurement crews. These crews, furnished by Jerrold Electronics Corporation, are especially trained for their tasks. They are assigned locations in such a manner that the entire area under consideration is sampled approximately once each month.

The measurement techniques, as explained by Mr. Skrivseth, are as follows:

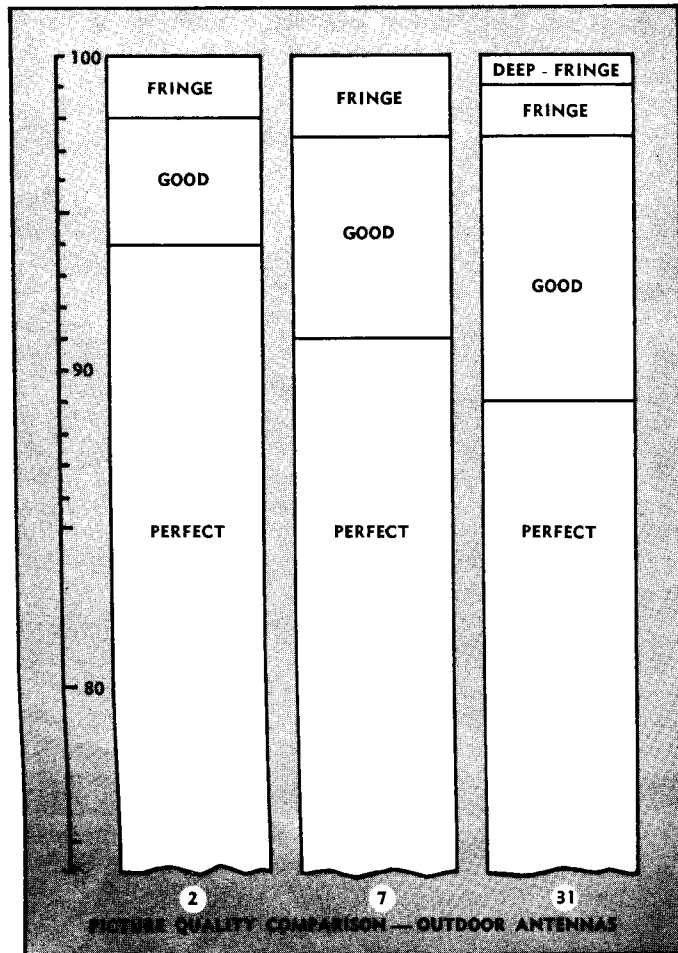
The measurement team arrives at a location, equipped with portable TV receiver, portable field-strength set (specially calibrated at the FCC labs), a standard VHF antenna, and a standard UHF antenna. The first step is to obtain the best possible picture for "any practical location" for an indoor antenna. Measurements are then made of the voltage obtained on the receiving antenna in use. These observations and measurements are made on all three channels—2, 7, and 31.

Whenever possible, the measurement crew then tries outdoor locations with the same equipment except that on VHF a 3-section traveling-wave antenna replaces the standard "indoor" antenna. On UHF, the dipole-in-corner-reflector is standard for both indoor and outdoor use.

On both indoor and outdoor tests, the measurement crew evaluates picture quality with respect to thermal noise, man-made noise, and ghosting, using special data sheets prepared for the experiment. If ghosting is present, displacement and estimated amplitude of ghosts are noted.

At the more-permanent 1,000 fixed locations, a slightly different technique is followed. Here, each location has an "optimized" antenna installation. The installation crews started with the simplest possible antenna installation, increasing its complexity as necessary until the best possible picture (up to grades 1 or 2 of the TASO scale) was obtained. These re-

(Continued — Page 19)



"Vive la Difference!"

by
Mr. I. Switzer
Co-Ax TV Ltd.
Estevan, Saskatchewan
Canada

Americans living along the Canadian border and those travelling in Canada have no doubt noticed a distinct difference between television broadcasting in Canada and the United States. This difference in television broadcasting makes for a difference in community antenna systems. CATV operators in more than two hundred Canadian communities say "vive la difference". This difference makes community antenna situations out of Canadian communities which would never support a system were they situated in the United States.

The Canadian Parliament, in passing the Broadcast Act of 1958, decreed that Canadian broadcasting was to be developed along distinctive national lines and was to be guided by a Board of Broadcast Governors. The Broadcast Act says, in part, "The Board shall, for the purpose of ensuring the continued existence and efficient operation of a national broadcasting system and the provision of a varied and comprehensive service of a high standard that is basically Canadian in content and character, regulate the establishment and operation of networks of broadcasting stations, the activities of public and private broadcasting stations in Canada and the relationship between them and provide for the final determination of all matters and questions in relation thereto." Technical aspects of broadcasting are controlled by the federal Department of Transport (DOT) under the authority of the Radio Act. The functions of the DOT are generally analogous to those of the FCC, in that the DOT controls licensing of all kinds of radio transmitters and is also authorized to license receivers. Under this authority the DOT licenses CATV systems as "Commercial Broadcast Receiving Stations". The Board of Broadcast Governors, which controls broadcasting policy, has no jurisdiction over CATV.

The BBG has decided that Canadian television broadcasting shall develop along distinctive Canadian lines and serve the "national purpose" by broadcasting more Canadian programs and fewer

American programs. Television broadcast licenses have been severely restricted in number in order to assure that those licensed should have the best possible chance to conform to the strict quotas on foreign programs and still pay their way. Beginning April 1st of this year Canadian TV stations must have at least 55% Canadian programming. Worded differently, this means that only 45% of programming on Canadian stations may be American productions. The BBG has been conscious for some time of the "vast wasteland" nature of American TV and has taken steps to create a television oasis (Canada) on this continent. The BBG has the authority and apparently the courage to formulate and enforce programming regulations for Canadian networks and stations that are, indeed, developing a distinctively different Canadian television broadcasting service.

Those Americans who have had the opportunity to notice that Canadian television is different from American television have probably also noticed that Canadians themselves *are not* basically different from Americans. Decades of living next door to the United States and being conditioned by American movies, magazines and radio has developed a kind of Canadian "camel", i.e. a large population that has a definite taste for the "vast wasteland" and is prepared to pay CATV service charges for the kind of antenna system needed to receive the U.S. programs that the BBG quota keeps off the local Canadian stations.

Actually this situation has made more business for antenna manufacturers than for CATV operators. Most of the large population centres of Canada lie within direct reception range of U.S. television stations, and these cities are veritable forests of television antenna all pointed "stateside". There are still many large Canadian centres beyond direct reception range or with serious terrain conditions affecting TV reception to give rise to a "professional" approach to CATV.

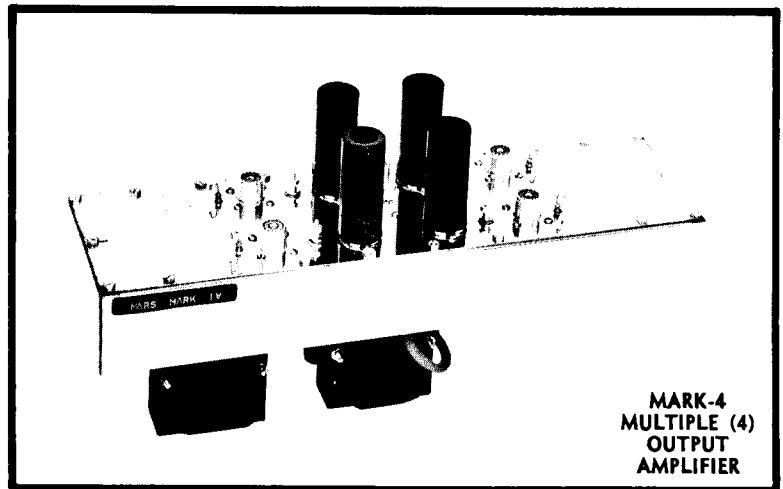
Canadian CATV opportunities lie principally in communities already being served by Canadian stations but which are not able to receive U.S. stations. There are still some communities that do not have even Canadian broadcast service but these are rapidly being serviced by rebroadcast stations being operated as satellites of Canadian TV stations in larger communities. The BBG does not permit translator rebroadcast within Canada of United States stations. A Canadian CATV operator providing

MARS ENGINEERING \$\$\$\$\$\$\$\$\$\$\$\$ \$\$\$\$\$\$\$\$\$\$\$\$ SAVES YOU MONEY!

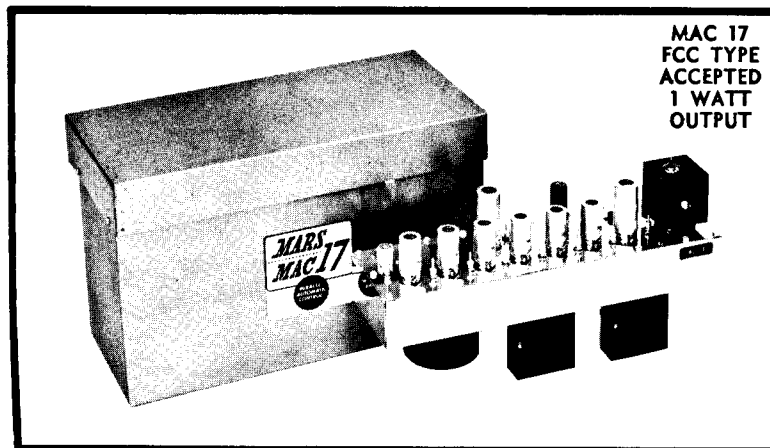
Here are the facts on two money saving units from MARS. The new Mark 4 Multiple Output Amplifier and the well-known MAC 17 Translator will both save you money by giving outstanding performance and unequalled maintenance economy!

THE NEW MARS MARK 4 MULTIPLE OUTPUT AMPLIFIER

- MULTIPLY EXISTING COVERAGE AREA BY FOUR
- DESIGNED TO SUPPLY ONE WATT IN FOUR DIRECTIONS TO ANTENNA SYSTEMS SERVING FOUR DISTINCTLY SEPARATE COMMUNITIES.
- MAY BE DRIVEN BY EITHER $\frac{1}{3}$ OR 1 WATT VHF TRANSLATOR.
- FOUR 6360 OUTPUT TUBES, INDIVIDUAL MONITORING OF POWER OUTPUTS
- FULL VOLTAGE REGULATION, WEATHER-PROOF HOUSING
- \$395.00



MARS ***MAC 17*** VHF TRANSLATOR



ONLY THE MAC-17 OFFERS:

- ALL INDUSTRIAL TUBES
- OPTICAL IDENTIFIER
- LESS THAN 50 WATTS AC POWER DRAIN
- SINGLE UNIT CONSTRUCTION, SUPPLIED WITH WEATHER-PROOF HOUSING
- 100% VOLTAGE REGULATED
- SMALLEST AND LIGHTEST TRANSLATOR
- \$933.00 LIST, \$700.00 NET

MID-AMERICA RELAY SYSTEMS, INC.

A SUBSIDIARY OF MIRATEL ELECTRONICS, INC.

918 Tilford Street, Sturgis, S.D.

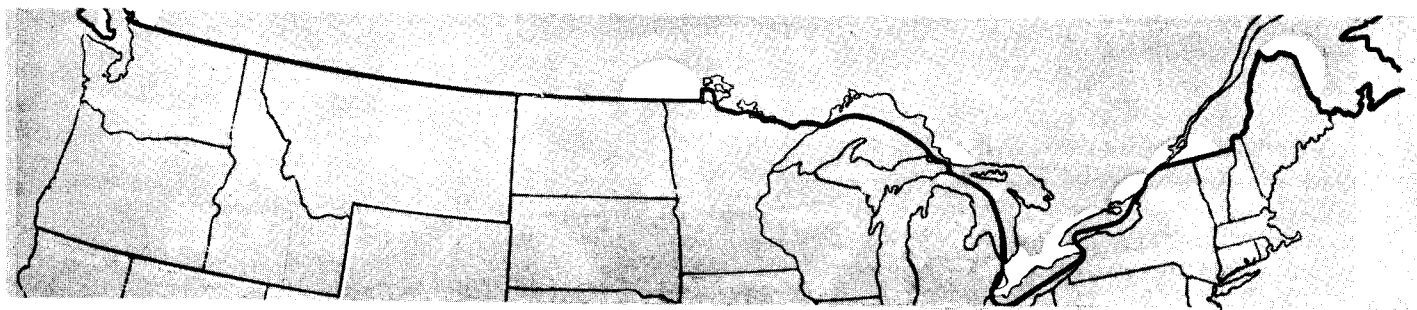
Dealer, Distributor Inquiries Invited

reception from U.S. stations is thus assured that no translators or satellites will spring up to duplicate the service that he is providing to subscribers. Because of the strong demand for reception of U.S. stations a thriving CATV industry has grown up in Montreal, a metropolis of more than one million population. A city of such size in the U.S.A. could never be considered as a CATV opportunity. The Canadian government broadcast policy as administered by the BBG has created a kind of "financial insurance" for CATV investment in Canadian systems that provide U.S. stations. Canadian CATV systems which cannot provide U.S. stations suffer from the prospect of rebroadcast stations or satellites, often financed by the Government, taking over their community functions. Canada is so firmly committed to the policies expressed in the Broadcast Act that no change is in prospect in the foreseeable future. None of the political parties in Canada have promised any change in these policies. CATV, therefore, has a secure long term future in Canada.

Canadian broadcast policies represent the view that television broadcasting and the spectrum space used is too precious and too powerful a force to be used only for entertainment. Entertainment func-

signal available for the community to be served. Needless to say this has severely restricted the application of microwave in Canadian CATV and has so far prevented establishment of CATV in many desirable Canadian communities, and is the main obstacle to an unlimited expansion of CATV in Canada. Canadian CATV systems must be based on technical systems acceptable to the licensing authority. This means direct cable connection (usually not exceeding 10 miles) to an off-air receiving site.

An editorial digression is appropriate at this point. DOT licensing regulations prevent establishment of CATV systems in a number of large Canadian cities which are so far from the U.S. border that they could be served only by microwave. Although the DOT has the authority to license private home TV receivers and to impose conditions on these licenses (such as prohibiting reception from the U.S.), no Canadian government has seen fit to commit political suicide by imposing such licensing on individual private TV sets in Canada. The Government has seen fit to impose such restrictions only on those TV sets connected to CATV systems. Licensing a CATV system effectively licenses each TV set connected to that system. A CATV system should



Light areas on map show VHF broadcast coverage in Canada of US stations. These cover the largest population centres in Canada—Vancouver, Winnipeg, Southern Ontario. Note that Montreal is on the fringe of VHF coverage. This is reason for CATV growth there. Topography problems in Vancouver have been foundation for large number of CATV systems there.

tions fall back on CATV and closed circuit. CATV subscribers watch Canadian stations to be informed and instructed; they watch U.S. stations to be entertained.

The commercial development of a CATV situation requires not only a community with a television reception problem, but also a *technical solution* for that problem. Canadian CATV systems also need political solutions. There are many worthwhile Canadian CATV situations beyond the range of "ordinary" technical solutions. No tall tower, hill, or mountain will bring reception to a community 500 miles from the nearest U.S. TV station. Microwave is the only technical solution to this kind of TV problem, and this is where the political problem arises. The DOT, licensing authority for Canadian CATV systems, will not license CATV systems that use microwave relays to provide signal pickup to CATV systems in communities already served by Canadian broadcasting stations. This is interpreted to mean communities lying within the B contour of a Canadian station. Microwave cannot be used anywhere in Canada to relay U.S. stations *unless* this is the *only*

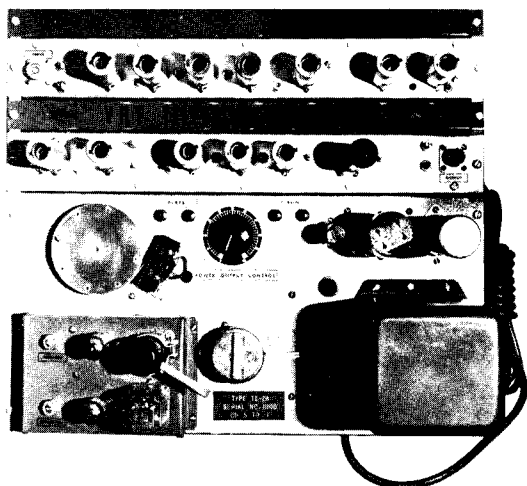
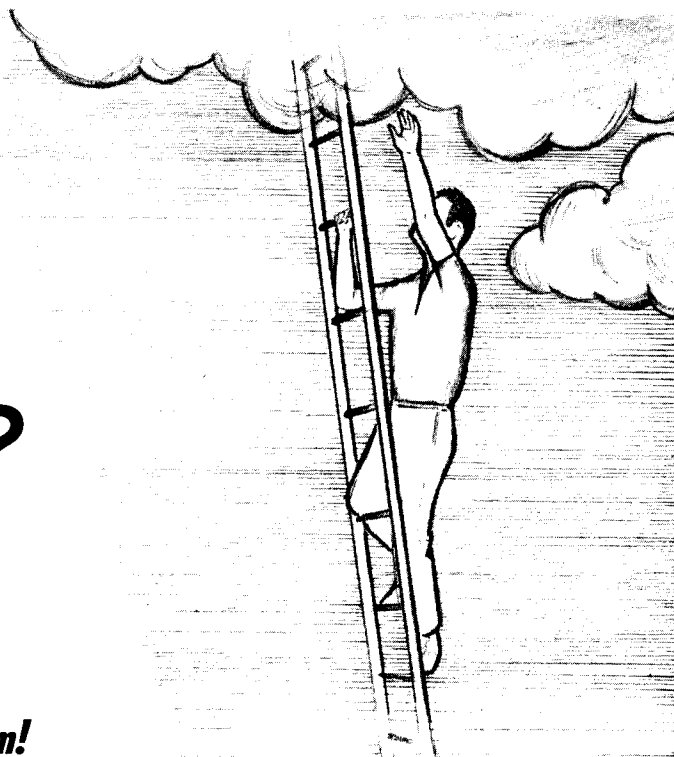
enjoy all the rights and privileges that its subscribers have as individuals. This issue is presently being argued with the federal government on these grounds. Canadians in more remote cities should have the same privilege of receiving U.S. stations as their fellow citizens living right along the U.S. border and enjoying rabbit ear reception from the United States. If Canadian broadcast channels are reserved for Canadian programs then citizens should be permitted to establish private non-broadcast systems for reception of U.S. programs. The main battle against direct reception of U.S. stations is already lost since 55% of the people in Canada live within direct reception range of the United States. Use of microwave to develop CATV systems further from the border would add only 5% of the population to the number already viewing U.S. stations. This 5% is a small part of the total population but represents a tremendous CATV business opportunity (900,000 people or 200,000 homes).

The licensing restrictions which have restricted CATV development have, however, been of some benefit to CATV operators. The \$25 license fee

IS YOUR TRANSLATOR GROUP

Still Reaching to Meet... FCC REQUIREMENTS?

**HERE IS THE EASY WAY TO
"GET OVER THE LICENSING HUMP"...
and Complete Your VHF Translator Program!**



Replace your old equipment with a brand new FCC type accepted TEPCO translator — The TE-2A. Only \$795.00 for a complete 1-watt unit, with power output meter!

The TEPCO TE-2A is completely self contained, and yet even at this most reasonable price, it contains all of the features normally found only in more expensive units. Ceramic coil forms, ceramic tube sockets, industrial type tubes and a big-husky power transformer. This unit is built to last and last and last. Outstanding performance is built into every TE-2A. It weighs 30 lbs. without cabinet! The weight alone tells you this is not "stripped down" construction.

NEW! VHF POWER OUTPUT METER FROM TEPCO. This unit measures peak video power, not the inaccurate figure that is often obtained when the aural and video power is combined. Write for full details today.

Other Quality TEPCO Products Available

TE-1B VHF Translator — Unsurpassed engineering excellence for the most exacting translator requirements.

TE-M Multiple Output Amplifier — For use in areas where FCC regulations will allow multiple output stages to cover more than one distinctly different communities.

For information on these and other
Quality TEPCO Products—write to:



TEPCO CORPORATION

P. O. Box 2065

Rapid City, South Dakota

Phone 343 7200

places the CATV system under the protective mantle of federal jurisdiction. Canadian communities have no more say, through franchise, for example, over CATV operators than they have over the local TV or radio station. The DOT sets uniform conditions for licensing and operation and grants as many licenses as there are competent applications, competent meaning completion of simple application form and submission of the \$25 fee. CATV, radio and television operate under federal jurisdiction and are therefore immune to the vagaries of local politics. One province does have legislation authorizing towns and villages to grant CATV franchises, but it is universally opined that this legislation would be declared ultra vires if it were contested. Authority over CATV rests exclusively with the federal government, but excepting the case of restriction of microwave the authority has served as a worthwhile protection rather than as oppressive regulation. The federal government has further served CATV by making it an offense against the criminal code to "steal" signals from a CATV system.

The effective CATV franchise rests with the agency, usually the telephone company, controlling pole attachment rights. Practically all the telephone companies in Canada have formulated CATV policies which are considered satisfactory by CATV operators. Contracts with Canadian Bell are being used as precedents in conducting negotiations with Bell systems in the U.S.A. CATV franchise in Canada consists in having the initiative and resources

to go ahead. Still, the prospective CATV operator must have a licensable technical solution. Remember, microwave is not allowed. CATV has been developing in Canada since before 1953 and it is not surprising that by this time (early 1962) all the "easy" CATV situations have been taken up.

Cracking some of the remaining desirable CATV situations has required some ingenuity. Several U.S. TV stations have been established close to the border which derive most of their income from advertisers in Canada. These stations make their living by satisfying the same appetite that the CATV operator serves. The situation is analogous to situation along the Mexican border where Mexican licensed stations are serving U.S. border communities. BBG regulation cannot be extended to these border stations since they are outside Canada. The FCC has licensed these stations since they perform a useful broadcast function within the United States. The Canadian government cannot prohibit Canadians from receiving these border stations since doing so would create a "police state" as reprehensible as any behind the Iron Curtain. Subscribers to a CATV system cannot be denied reception rights that their non-CATV neighbours enjoy, so CATV systems, in such a case, must be, and are, licensed to receive U.S. border stations.

It soon became apparent that CATV could be developed in a few Canadian communities if there were more U.S. stations along the border. The number of VHF border stations is limited by available VHF allocations and by the high cost of building and operating such stations. However, UHF translators do not suffer from these problems. UHF translators are comparatively low in cost and there are plenty of channels available for their operation. They are licensed by the FCC as public broadcast stations and enjoy the same "diplomatic immunity" in Canada as their most costly and powerful VHF counterparts, and they provide the same desirable broadcast programs that the VHF broadcasters do.

UHF translators can be encouraged and subsidized by Canadian CATV operators so long as the spirit and letter of FCC regulations are scrupulously observed. Control of the translator must be held by licensees eligible under FCC regulations. The translator must provide free broadcast service to an American community that needs it. Rebroadcast permission must of course be obtained from the originating station. Function as a relay must be incidental to the translator's basic function as a broadcast station. Since the subscribers of the Canadian CATV system receiving these translator broadcast signals is usually very much larger than the American community concerned it is only fair that these subscribers, through the agency of the CATV system, should pay most of the costs.

Canadian CATV systems using such translator broadcast signals are from 30 to 60 miles from the border. At this range, the reception from low power translators presents some technical problems that

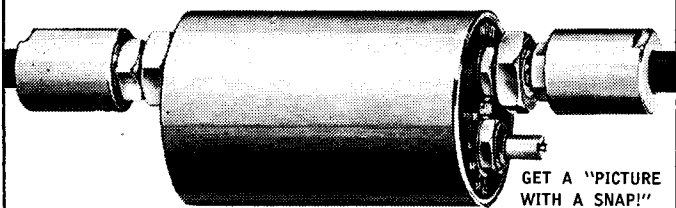
(Continued — Page 21)

Three years ago **BENCO** pioneered the First

TRANSISTORIZED CATV SYSTEM

Now **BENCO** Presents the Advanced
"Model 3" Transistorized CATV System

- AC POWERED — 20-50 Volts AC or DC
- TWO YEAR WARRANTY — On the New
"Model 3" Transistorized Amplifier.



- Unique automatic gain control maintains signal levels over entire system
- 7 channels—5 low band and 2 sub-channels—22 Mc/s to 88 Mc/s
- 2000 feet amplifier spacing when low loss cable is used
- ONE transistorized power supply for several miles of cable
- T-AMP-3 transistorized amplifier is hermetically sealed

BENCO

TELEVISION ASSOCIATES LTD.

27 Taber Road, Rexdale, Ontario, CANADA

In U.S.A. Blonder-Tongue Laboratories, Inc.
9 Alling Street, Newark 2, N.J.

CATV REFLECTIONS

by Jacob Shekel

Spencer-Kennedy Laboratories, Inc.
1320 Soldiers Field Rd., Boston 35, Mass.

The problem of reflections arises in any application where transmission lines are used. A uniform line—for example, a coaxial cable—can transmit signals equally well in both directions. However, any discontinuity in the line or any deviation from a uniform cross-section, results in coupling between the signals in both directions. A signal going one way is partially reflected at the discontinuity, and thus causes another signal that goes in the opposite direction.

The reflected signals may limit the performance of the system in various ways:

1. Obviously, the reflection of signal power back into the source means that less useful power is delivered to the load at the end of the line. This effect is most important when efficiency of power transmission is the prime factor, as is the case in a line that connects a transmitter to the antenna.

2. The signal that is reflected interferes with the original signal, so that the signal voltage along the line exhibits periodic maximum and minimum values. This is the phenomenon of *standing waves*, and the ratio of maximum to minimum voltage is the *voltage standing wave ratio* (VSWR). This effect is sometimes used to measure the ratio of the reflected and transmitted signals (reflection coefficient).

3. The net voltage at a maximum point is higher than would exist in the line if the same power were delivered with no reflections. Thus the maximum power handling capacity of the line is reduced. Because of the standing wave pattern, the net loss in the line is also increased, when compared to the reflection-less condition.

4. Of special interest in TV systems is the fact that the reflected signal may appear as an echo (or "ghost") on the TV picture. A reflected signal may appear as a ghost on any receiver that is connected to the line at a point preceding the source of reflection; or the reflected signal may be re-reflected from another discontinuity and proceed along the line in the same direction as the main signal. In any case, the ghost will be delayed with respect to the main signal, and will appear on the screen as a fainter picture, displaced to the right of the main picture.

TV systems are especially sensitive to the effects described in the last paragraph, and they become objectionable in cases where the other effects are barely noticed. The subject of this article (and another article that will appear next month) is a detailed quantitative discussion of the effects of "ghosts" in TV distribution systems, and how it affects the specifications of system components.

Reflections

Any deviation from a uniform cross-section of the transmission line may cause reflections. The uniformity of the cable, of course, is controlled by the cable manufacturer, who does his best to keep the dimensions within necessary tolerances, and to keep the dielectric free from any irregularities. The splices and connectors are usually designed to form a transition which is as smooth and gradual as possible.

But there are points on the transmission line where discontinuities cannot be avoided. The system includes amplifiers, equalizers, filters, line-taps, and other components, and at each junction of the cable with an instrument there has to be a discontinuity. Fortunately, it is possible to design the elements in such a way that, although the component does not look like the cross-section of a coaxial cable, it has very similar electrical properties, so that the reflection at the junction is minimized. The lower the reflection, the better is the component matched to the transmission line.

The reflection at any junction or discontinuity is measured by the *reflection coefficient*, which is the ratio of the voltage of the reflected signal to that of the incident signal. When this ratio is expressed as a positive number of decibels, it is called the *return loss*.

Minimum Perceptible Echo

The question now arises, what is the maximum reflection coefficient (or, equivalently, the minimum return loss) to be allowed on a transmission line, that will not appear as a disturbing echo on the TV screen?

Since the judgment of picture quality is a subjective affair, the question does not have a unique answer. Many experiments were conducted, by different organizations, about subjective judgment of pictures degraded by echoes, and Fig. 1 shows a representative curve that is widely accepted as a standard. This curve is described as a "summary curve, taken as reasonably representative, smoothed from data covering pictures and engraved geometrical forms."⁽¹⁾

The curve shows the smallest echo which is just perceptible on the screen. Its amplitude is given relative to that of the original signal, and it is a function of the delay between the picture signal and the echo. The curve can be described by three characteristic features:

1. No echo is perceptible on the screen, if its delay is less than 0.018 microseconds. This delay corresponds to a horizontal displacement which is about 1/3500 of the width of the picture, so it is well below the resolution of the TV picture.
2. As the delay increases, the amplitude of the

(1) P. Mertz, "Influence of echoes on TV transmission," *Journal of the SMPTE*, May, 1953, pp. 572-596.

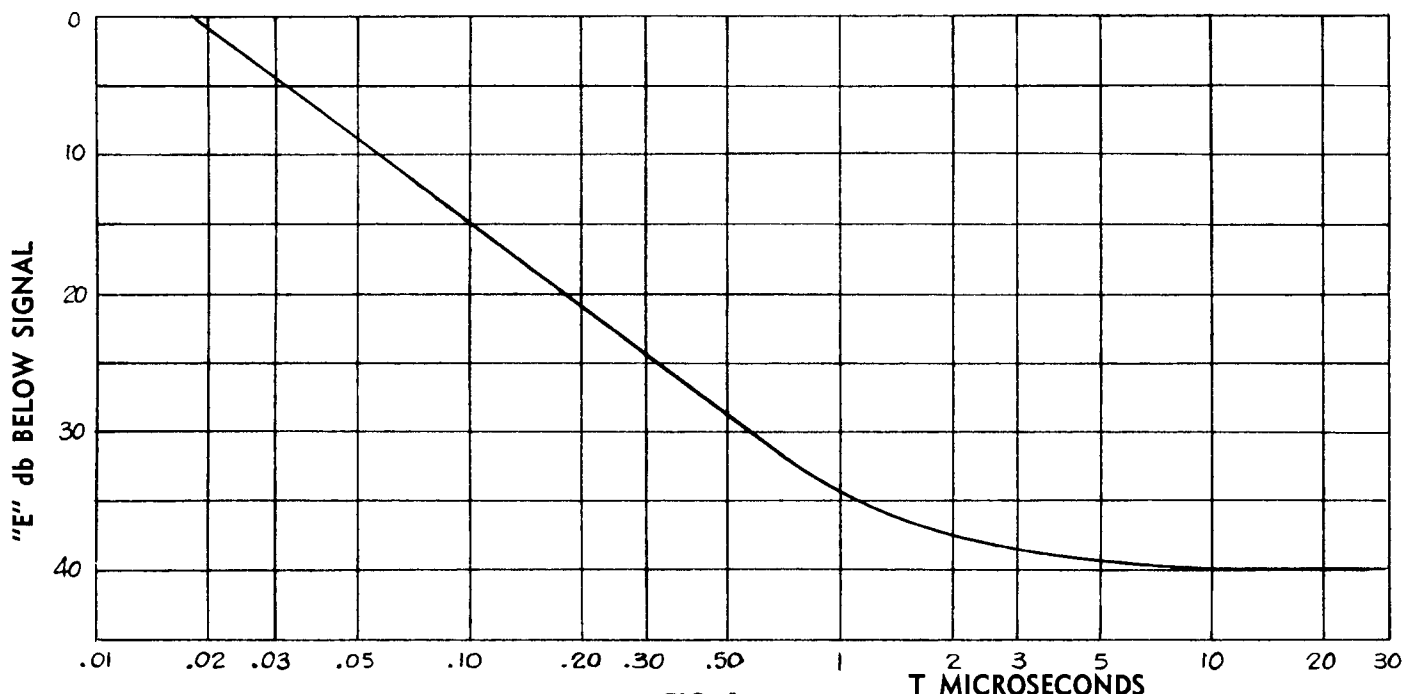


FIG. 1

REPORTED TOLERANCES ON ECHO AMPLITUDE AS A FUNCTION OF ECHO DELAY (REPRODUCED FROM REFERENCE 1)

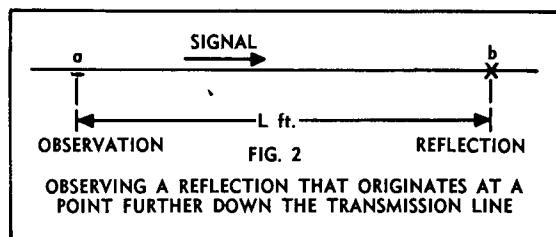
just-perceptible echo is inversely proportional to the delay; that is, if the delay is doubled, an echo will be perceptible, even if it is only half as strong (6 db down).

3. Echoes smaller than 1% in voltage (-40 db relative to the signal), are not visible at any delay. The curve therefore gradually changes from the downward sloping line towards the horizontal 40 db line.

Effects of Delay and Loss in a Cable

A section of a CATV line, with the signal supposedly going from left to right, is shown in Fig. 2.

Suppose that the signal at point a is observed on a TV set, and that there is some reflection at point b which is L ft. down the line. Assume that the signal at a is tapped by a simple non-directional tap-off, that responds equally to signals going in both directions (for example, a simple capacitor tap-off from the center conductor).



The echo will be delayed, with respect to the signal, by the time it takes a signal to go from a to b and back to a . If v is the velocity of propagation of signals along the line, the delay T is related to the distance L by

$$L = vT/2.$$

The echo/signal ratio at a is not the same as the reflection coefficient at b , because of the losses along the path a - b . Let α be the loss of the cable in db/unit length. The signal is attenuated αL db before

it hits the reflecting obstacle at b ; the echo is again attenuated by αL db on its way back to a . The echo at a , compared to the signal at the same point, is then $2\alpha L$ db lower than the reflection coefficient at b . As a result, the tolerable echo at b is $2\alpha L$ db larger than that indicated by Fig. 1.

Fig. 3 shows a typical plot of the tolerable return loss at b as a function of L . This plot is obtained from Fig. 1 by changing the horizontal scale from time T to distance L , according to the velocity of propagation, and by subtracting $2\alpha L$ db from the maximum tolerable return loss at every point. The specific numerical values depend, of course, on the loss factor α , but every curve will have three distinctive features:

1. There is a maximum distance, L_m , at which echoes are perceptible. Any reflection, of whatever magnitude, that occurs further than L_m from the point of observation, will be attenuated below perception.
2. There is a critical distance, L_c , at which the specification on permissible return loss is most severe. This is a region rather than a sharply defined distance, because the curve is quite flat at its minimum.
3. There is a critical value, E_c , for return loss; any return loss higher than E_c will not cause a perceptible echo, no matter at what distance from the point of observation the reflection occurs.

The actual values of these constants depend on the losses in the cable, and are therefore a function of frequency. Their meaning, as defined above, is strictly valid for single reflections only. The cumulative effect of multiple reflections will be briefly mentioned in the next section.

Fig. 4 shows the curves computed for RG-11/U coaxial cable, at the loss values corresponding to 54 mc and 216 mc.

(Continued — Page 20)



OUR MAN IN EUROPE

GORDON J. KING

Assoc. Brit. I.R.E.

Brixham, Devon, England

Almost all early British CATV systems had no network AGC. In fact, there are still many small systems operating quite well with up to a maximum of about eight repeaters in cascade from the beginning to remote terminations with only source AGC.

The Brixham system, for example, (population 10,000) with an overall trunk cable length approaching 1½ miles, is devoid of network AGC. This is made possible by sitting and adjusting the repeaters to work, at least, 10 db below maximum inter-modulation-free output.

In this country it has been discovered that a signal level tolerance of that kind of order caters for rises of signal due to temperature reduction of the cables and their consequent decrease in attenuation. But this applies only to small systems where the trunk loading is fully established at the launching.

THERMISTOR CONTROL

There have been several attempts to equalise against thermal variations of cable attenuation by the use of thermistors in the repeaters themselves. The well-known coaxial relay equipment manufacturer, Teleng Limited, exploited this idea many years ago. The thermistor was placed in a repeater where

it was influenced by changes in air temperature, and the resulting change of resistance of the thermistor was reflected in terms of bias change on the amplifier valves.

This was found to have limited value. The main snags were in obtaining the optimum temperature coefficient in relation to cable which was partly overhead and partly underground and in varying degrees of shade.

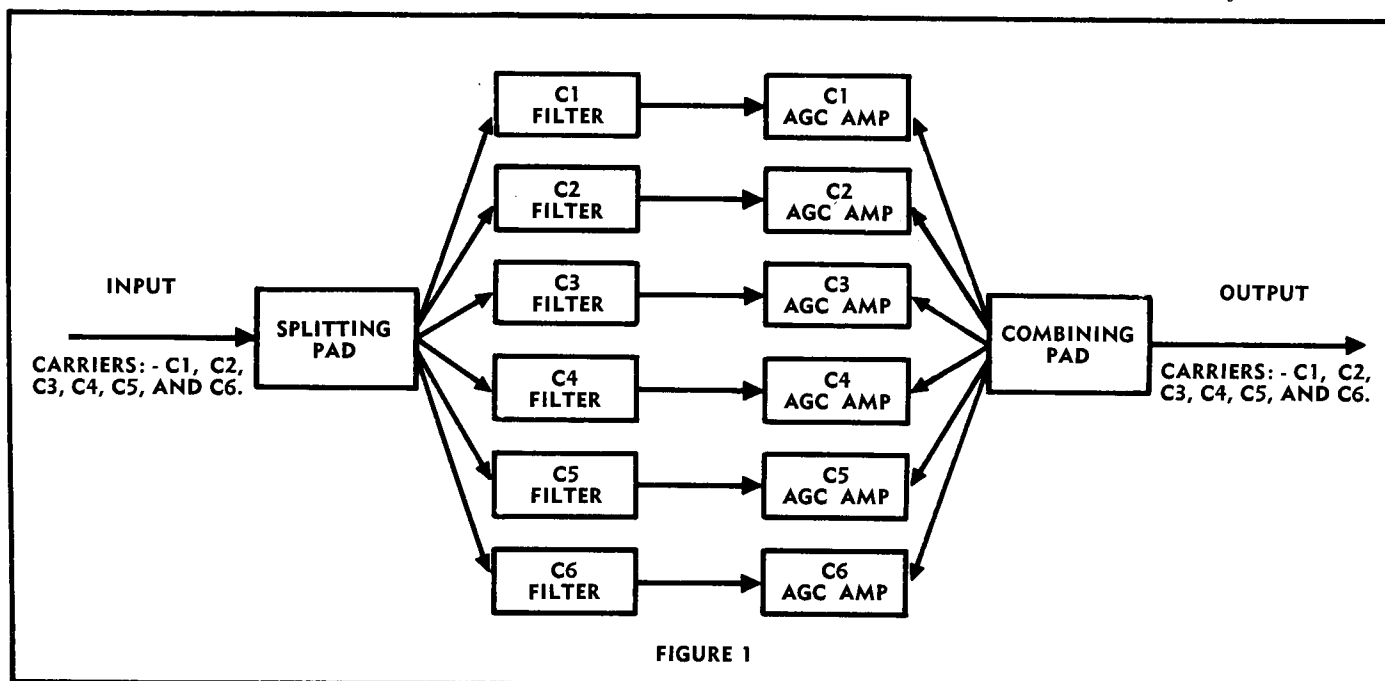
MEAN LEVEL AGC

Another idea which was incorporated in the repeaters was a so-called mean level AGC circuit. Here the sound or vision carrier of a specific channel was extracted at high impedance from the final stage of a repeater and applied to a separate amplifier, the signal output of which was rectified. The resulting direct voltage was smoothed and filtered and used as an AGC bias for the repeater amplifier valves.

This was reasonably successful, but had two major disadvantages. One was the high signal level that was required to produce a useable control bias, and the other was that in the event of failure of the carrier selected for the control, the whole system went haywire.

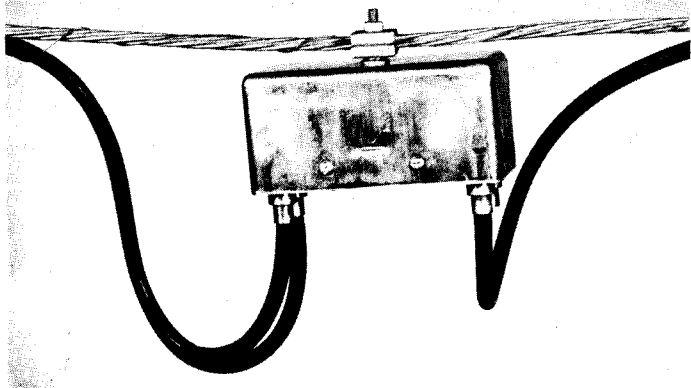
PILOT CARRIER AGC

Although this arrangement is probably very well known to my readers, it has been included for the sake of completeness. It is used mainly on the EMI



CUT MAINTENANCE AND INSTALLATION COSTS . . . UP TO 90 PERCENT!

The **CAS Transistor CATV AMPLIFIER** is the proven answer to your line amplifier problems.



CAS has put all the engineering know-how of 10 years CATV experience into the design of the TR-95a. Now you can put this knowledge to work . . . cutting your operating costs and saving dollars every day of the week!

TR-95a FEATURES

- COMPLETELY TRANSISTORIZED • WIDE BANDWIDTH (54 to 95 mc at 30 db gain) • CABLE POWERED • TWO INPUTS . . . TWO OUTPUTS, for line bridging or cascaded runs • GAIN AND TILT TEMPERATURE COMPENSATED • TILT ADJUSTS WITH GAIN CONTROL (gain control is a 20 db variable pad on input) • WEATHER-PROOF, STRAND MOUNTING ENCLOSURE • TABS CONTROL FLOW OF CURRENT IN AND OUT OF THE AMPLIFIER • TRANSISTORIZED CIRCUIT CUTS OPERATIONAL EXPENSE MANY TIMES OVER . . . ELIMINATES MUCH OF ELECTRIC POWER METER EXPENSE; 10-12 AMPLIFIERS CAN BE RUN OFF ONE METER! (Right now, small towns are operating systems on a Single Power Supply!)

Remember . . . CAS Manufactures **ONLY** Transistor CATV Systems!

It's our **only** business! And we make it our business to save **You** money. Write today for information on our complete line including Transistor Line Amplifiers, Bridging Amplifiers, Extenders; Matched Line Splitters (which pass voltage for line powered systems).

— You Can Count On CAS! —

CAS

MFG. CO.

P.O. Drawer B — Mineral Wells, Texas — FA 5-5124

ultra wideband CATV systems. A crystal controlled pilot carrier at a frequency towards the centre of the network passband is injected at source. This is passed by the network repeaters, but at certain repeaters the signal is extracted, amplified and rectified and used to provide an AGC bias. The bias is thus dependent on the network attenuation, and as this rises and falls due to thermal effects, so the gain of the repeaters featuring AGC changes to compensate.

There are very many systems in the UK using this kind of system, which is also popular in Europe generally, and it works very well indeed. An AGC repeater is used in the ratio of about every three or four "straight" repeaters.

AGC PER CARRIER

Let's face it, a coaxial network is a compromise in matching. A high degree of cable match, impedance-wise, throughout a large system is virtually impossible. It is agreed that very good VSWR's can be achieved in local equipment, but overall on an extended network this desirable condition quickly goes to the dogs. Odd things happen. After a mile or so of trunk, carriers tend to rise and fall in relation to each other. Intermodulation starts playing nasty tricks, and one then usually resorts to critical carrier level adjustments at source. The system becomes highly critical and lots of engineering time is burnt up in maintaining the delicate balance!

This undesirable state of affairs has been alleviated to quite a large extent here in the UK by breaking the network up into service areas, each area being controlled by its own sub-station, as described in past reports.

The multiplicity of signals are filtered independently at each sub-station and each carrier (or channel) is applied to its own AGC amplifier. Each amplifier also has a manual level control. This certainly makes relay life less frustrating, for now all the outgoing carriers can be reset to the correct levels, and these are sure to be maintained by the AGC in spite of what may happen to the input levels.

When this arrangement is adopted, highly effective filtering of the various carriers into their respective amplifiers is essential. Also, each amplifier must have a response, at least, 50 db down at adjacent carrier frequencies, and there must be no spurious responses which would be likely to allow the passage of a carrier which is removed from the design pass-band of the amplifier.

Some systems have fallen down simply because these factors were not wholly satisfied. A six-carrier set-up is depicted in Fig. 1, and this may well represent a three-channel TV system with three sound carriers and three vision carriers. All is very well provided each carrier is kept to its own little circuit. However, if, for example, a little of carrier one gets into carrier two circuit there are real fun and games. Let us suppose that carrier one carries a vision signal and that carrier two looks after the accompanying sound. Two C1 vision signals are thus going to enter the outgoing networks. There will be the correct signal via C1 circuit plus a very distorted signal, though at lower level (we hope), via circuit C2.

Apart from the response distortion resulting from a vision signal passing through a relatively narrow band circuit, the delay characteristics between the two circuits differ considerably. This is displayed

(Continued — Page 24)

UHF TEST—Continued from page 9

sults are to be evaluated separately to determine antenna complexity necessary.

How is the signal evaluated?

Each evaluation for each channel is made on a "Measurement Survey Data Sheet". The upper portion of the sheet identifies the location and equipment in use, as well as the date, channel, and time of the evaluation. Picture rating is made in a six-step scale, as follows:

Step 1 means "excellent". The definition is "The picture is of extremely high quality, as good as you could desire. Noise or multipath effects not perceptible."

Step 2 is "fine". The picture is of high quality providing enjoyable viewing. Picture degradation is, however, perceptible.

Step 3 is "passable". The picture is of acceptable quality. Picture degradation, while present, is not objectionable.

Step 4 is "marginal". The picture is poor in quality and "you wish you could improve it". Picture degradation is somewhat objectionable.

Step 5 means "inferior". The picture is very poor but you could watch it. Definitely objectionable picture degradation is present.

The last step, 6, is "unusable". The picture is so bad that you could not watch it.

Ghosting is rated first by the number of ghosts present. Relative intensity is estimated as a percentage of the main signal intensity. Negative ghosts are identified by circling the percentage figure. Presence or absence of smearing on the ghosts is checked.

Delay is measured in inches on the face of the screen. Since all sets in the survey use the same size screen, this information can be translated directly into microseconds of delay. If the ghost leads the main signal, the delay is indicated as a "negative" figure.

Overall ghosting grade is rated on the same six-step scale used for general picture quality, but considering only degradation due to ghosts.

Man-made noise is evaluated by switching to an unused channel and observing the effects of man-made noise on the raster in the absence of any signal. If adjacent or co-channel interference is visible, this is not considered "man-made noise".

Sound quality is rated on the same scale used for picture quality, substituting the word "sound" for "picture" and "listening" for "viewing" in the definitions of each step.

The lower portion of the form, dealing with measurements, is self-explanatory.

As mentioned earlier, one such sheet is filled out for each evaluation on each channel. This means that at each location, at least three such sheets are completed. If both indoor and outdoor measurements are made, six sheets are filled out. With 5,000 locations in use and each location being sampled at least once a month for the full duration of the 12-month test, this means that more than 150,000 separate evaluation sheets may be completed. These 150,000 sheets will contain the raw results of the test.

What's going to happen to the data after the test ends (sometime near the end of this year)?

The exact processing techniques for test results have not yet been revealed. The results will "ultimately" be transferred to punch cards for possible

computer analysis, but Mr. Skrivseth explains that the actual mechanics of the transfer must await review (by data-processing specialists) of preliminary results to determine the most efficient processing methods.

At the beginning of the test period, some segments of the TV industry questioned the legitimacy of comparing UHF service with existing VHF operations. They appeared to feel that the purpose of the NYC test was to show "what can be done" with UHF.

E. W. Allen, chief engineer for the FCC, explains that this was *not* the purpose of the test. The real purpose, he continued, was to obtain a quantitative measure of the kind of service that can be rendered in New York City by reasonable installations. Since no absolute measure of just what is or is not satisfactory service exists, comparisons with VHF provide the only adequate index of "satisfactory" service.

Mr. Skrivseth went into more detail. "Since no broadcast service is perfect," he explained, "it can be assumed that UHF will not be perfect. With this in mind, a reference is needed to determine what kind of service is adequate or tolerable for existing viewers.

"As a result," he continued, "the same kind of observations and measurements made on both VHF and UHF, at the same locations, determine how much better or how much worse UHF is than that service which the viewers now obtain.

"We are, of course," said Mr. Skrivseth, "open to some criticism that our installations will all be new installations. However, we are treating both bands alike and from existing information, such as that from TASO, deterioration of installations can be added as a separate factor."

Commissioners hope that results of this test, when available, will help answer the often-asked but never-scientifically-tested question, "Can UHF provide service equal to VHF?" Though the test is aimed primarily at the strong-signal area (within 25 miles of the transmitter), recording installations at Princeton, N.J.; Philadelphia, Pa.; and Laurel, Md. are also monitoring the signal. The data obtained by these RCA-installed facilities will be added to the other propagation data which have been collected by the Commission.

"Test patterns may come through fine, but what about program material?" This question won't affect the NYC test. Though the programming consisted primarily of test patterns during the preliminary stage (while antenna installations were being made, and during an auxiliary circularly-polarized experiment), the programming during the bulk of the test consists of duplication of programs from six New York VHF stations as well as some independent programming originated by the City of New York. This provides a signal modulated with a picture which is representative of the type viewed by the public, and offers in addition the chance for direct comparison of the same program on VHF and UHF. However, the direct-comparison feature is not an essential part of the experiment, and no special pains are being taken to assure the chance of comparison.

Despite the effort to remain impartial, the NYC test has found itself embroiled in politics. L. M.

(Continued — Page 24)

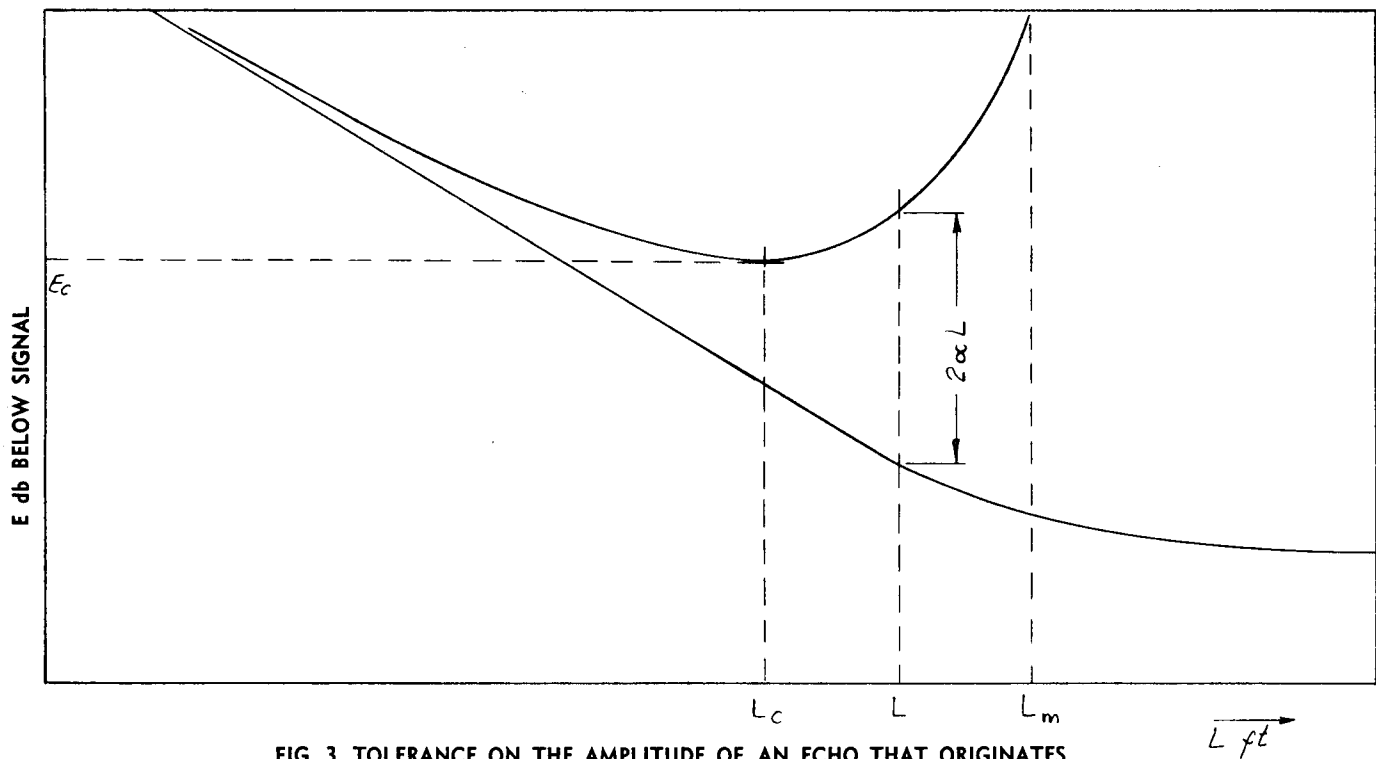


FIG. 3 TOLERANCE ON THE AMPLITUDE OF AN ECHO THAT ORIGINATES AT A POINT L FT. DOWN THE LINE

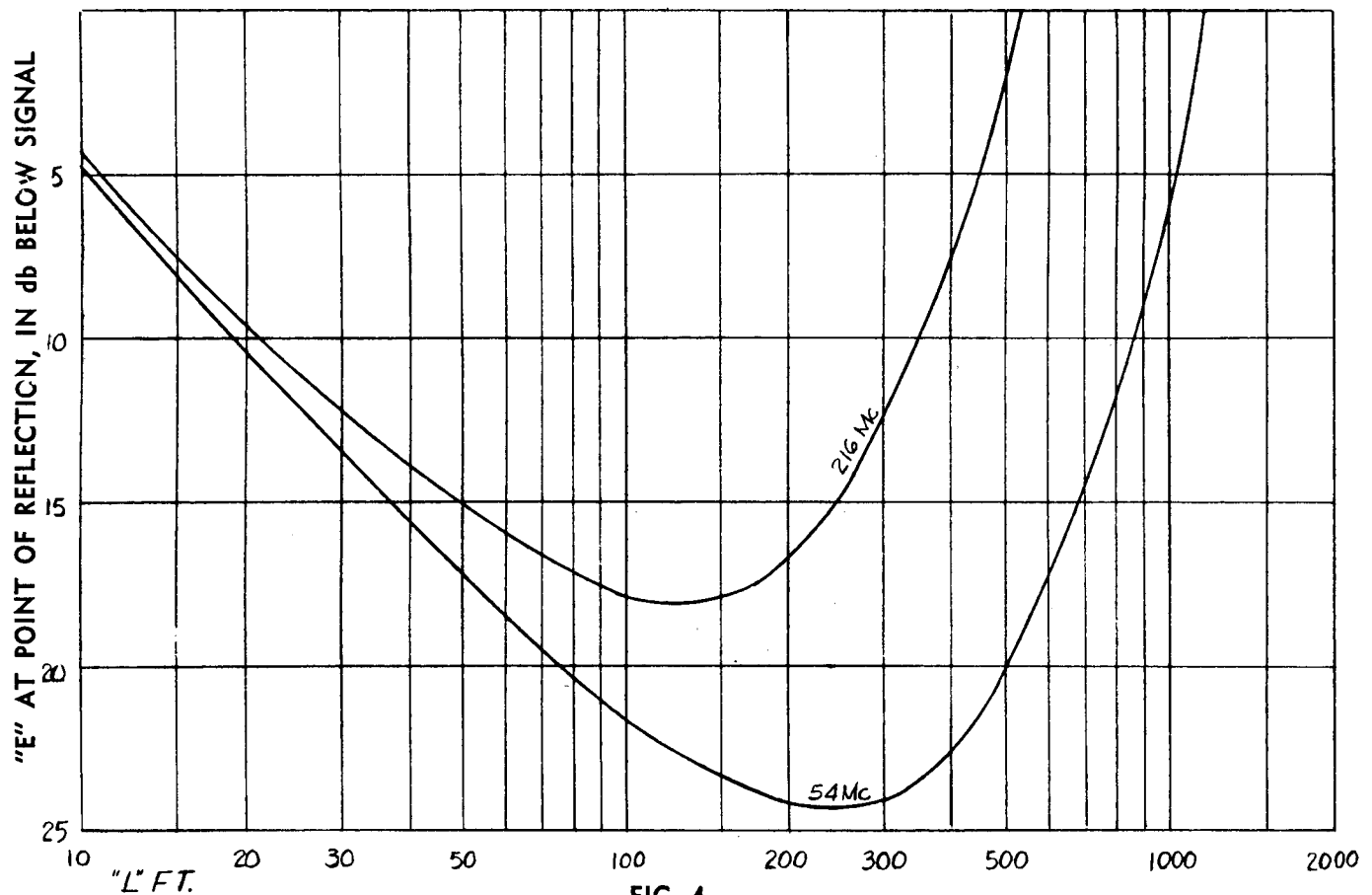


FIG. 4
TOLERANCE ON ECHO PRODUCED IN RG 11/U COAXIAL CABLE,
AS A FUNCTION OF THE DISTANCE BETWEEN POINT OF
OBSERVATION AND SOURCE OF ECHO

(Continued — Page 21)

VIVE LA DIFFERENCE—Continued from page 14
will be discussed in a subsequent article. Suffice it to say that a tall tower and sophisticated antenna system are required, and that such facilities can only be provided by a CATV system. Even if the community was within direct roof-top range of the translators it would be cheaper and more convenient to use CATV service. There are no all channel TV sets manufactured in Canada and converters and UHF antennas are 40% more expensive in Canada because they are imported from the U.S.A. Head end conversion by the CATV system provides efficient stable conversion and the convenience of using ordinary "click stop" VHF tuners.

Canadian CATV support of UHF translators along the border has provided TV reception to small American communities that could not otherwise afford translators. Because of this financial support from Canada these communities are further assured of adequate financing for maintenance. Not many American translator systems enjoy the high standard of installation and maintenance, and freedom from financial concern, as these subsidized translators along the Canadian border.

UHF translators have been installed in preference to VHF translators for a number of reasons, mainly technical. One of the reasons is a lack of faith in the long term future of VHF translators in the U.S.A. Technical analysis of this choice will be discussed in a subsequent article.

Border UHF translators have opened up a few more Canadian communities to CATV operators. There are still a number of communities that are attractive to CATV operators but which are beyond UHF translator range. Microwave is still the only technical solution for these communities. The National Community Antenna Television Association of

Canada is making active representations to federal authorities to get these regulations changed. There is some hope that this licensing battle will be won by the Association and that the remainder of Canada will be opened to CATV development.

CATV REFLECTIONS—Continued from page 20

Application to CATV Distribution Systems

There is an essential difference between the main trunk line and the distribution lines of a CATV system, when the possibility of perceptible echoes is considered.

The main trunk is usually a straight transmission line, with no side lines branching off it. Between any two amplifier stations, there usually is an uninterrupted cable section, with a loss that is usually 20 db or more. Any echo generated at a mismatch where the line joins an amplifier is attenuated more than 40 db on a round-way trip, and therefore will not be perceptible as an echo; it seems that the amplifier may even be completely mismatched, without causing any perceptible echoes.

In practice, this conclusion should be treated with some caution. The multiple reflections from many amplifiers, as well as the extremely low reflections from cable splices, although they do not appear as perceptible echoes, still have a cumulative effect. The mixture of these slight and uncorrelated disturbances degrades the final picture by effectively adding to the noise. However, the quantitative treatment of this effect is outside the scope of the present article.

The case is quite different in the distribution area, where the trunk line is branched into secondary lines, and those, in turn, are strung with taps for individual customers. As is evident from Fig. 4, the spacings between branchings and between taps are generally less than λ_m , and quite frequently fall in the region around λ_c . If the TV picture delivered

(Continued — Page 24)

FM MULTIPLEX

(Continued from page 6)

Stereo signal is critical, care must be taken to minimize phase distortions in the entire CATV system.

Whether these technical problems, as well as the additional equipment investment required, overbalance the opportunity for additional revenue, and for attracting new subscribers, is a question which each CATV operator must decide on the basis of his local situation. The techniques are available, and the possibilities exist. The rest is up to the operator.

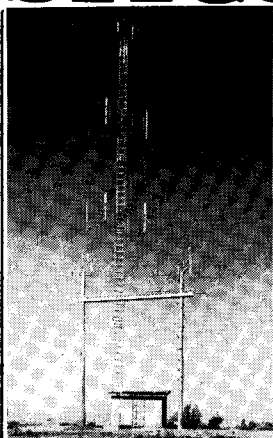
ABOUT G-LINES

In the interest of avoiding infringement of patent and trademark rights, it should be noted that the patent rights for "G-LINE" components and systems are owned by Surface Conduction, Inc., 1501 Broadway, New York 36, New York, which also owns the registered trademark "G-LINE".

SITCO

Heavy Duty Quads and Yagis

Designed by SITCO for Translator off-the-air pickup, Community TV and extreme fringe area requirements.



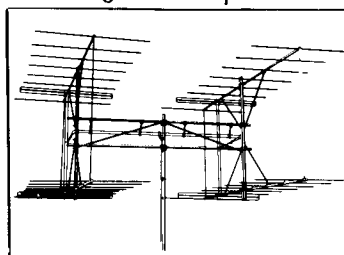
SITCO WEDGE SCREW FASTENERS



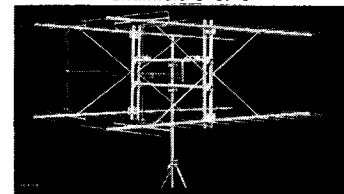
Write for Free SITCO Catalog

The SITCO Models 94 and 102 Quad Mount Antenna Arrays are designed to produce high gain, high front-to-back ratio and large aperture to weak signals. A completely balanced system which reduces noise pick-up and greatly improves the signal-to-noise ratio.

NOW, all SITCO element ends are machined to reduce static leakage. The signal-to-noise ratio is increased at sites where signal levels are low.



Model No. 94-HD 32-element Quad
Channels 5 or 6



Model No. 102-HD 48-element Quad
For all hi-band channels

SIMPLICITY TOOL COMPANY

2850 NORTH MISSISSIPPI • PORTLAND 12, OREGON

DANIELS TO ENTER PAY-TV?

The CATV industry is abuzz with speculation as to the future of channel 2, KTVR, Denver, since the announcement by Daniels & Associates that Bill Daniels had purchased the property for an estimated \$2 million.

The former owner of KTVR, J. Elroy McCaw, had contracted with Telelobe to use their system of pay-tv for a three year test.

**EXPERIENCE
PROVEN**

**BY OVER
\$16,000,000.00
IN SUCCESSFUL
CATV SYSTEM
SALES....IN JUST
FOUR YEARS.**

★ ★ ★ ★

**For Reliable System Sales,
the Highest Return on Your
Investment Dollar, Contact:**

THE DANIELS TEAM

**SYSTEM APPRAISALS
SYSTEM SALES
SYSTEM MANAGEMENT
NEGOTIATIONS**

Daniels & Associates, Inc.

THE DANIELS BLDG. — 2430 E. THIRD AVENUE
DENVER 6, COLO. — PH. DU 8-5888

In Canada: **FRED T. METCALF**
25 Crestwood Place, Guelph, Ontario
Telephone TA 2-2030

Daniel's interest in CATV, and its kindredship (someday) with pay-tv, raises speculation that Daniels may be planning on-the-air tests with the new channel 2 property.

AND . . . DANIELS ONCE AGAIN!

Daniels & Associates announced their 51st transaction in three and one half years. The deal consisted of the sale of the Tel-I-Clear System, Inc. CATV system, located in Laguna Beach, California. The CATV system was formerly headed by Lewis Lemieux, veteran California CATV operator, and serves approximately 2,300 subscribers. Purchaser of the property is Laguna Video, Inc., a corporation owned primarily by Narragansett Capital Corporation of Providence, Rhode Island, headed by Royal Little, former President and Chairman of the Board of Textron, Inc.

Daniels' subsidiary, Systems Management Company, will operate property under management contract. Mr. Lemieux has agreed to continue his services with the company for an indefinite period.

NCTA BOARD MEETING REPORT

The NCTA Board of Directors, reporting the results of its recent Board of Directors' meet in Las Vegas, noted that President Bill Dalton has increased membership by 20% over the past 12 months. Dalton joined the group only one year ago.

An announcement following the meet noted "the Board reaffirmed NCTA's position that no need exists for federal regulation and called for careful scrutiny of legislation introduced in Washington that would restrict economic growth of CATV." The Board also established a Microwave Study Group to provide information services to CATV systems and others interested in the orderly development of microwave availability that would permit broader applications of CATV in educational television, civil defense, emergency warning and weather services, and other broad areas of public interest.

"The Board also approved plans for NCTA's first management seminar scheduled for the University of Wisconsin in August, and plans for an institutional industry film that would create wider public understanding and acceptance of CATV."

The Board elected Lloyd Calhoun, Hobbs, New Mexico, to fill the unexpired term of Norm Hen-



dry, Prescott, Arizona. Hendry recently resigned when his CATV system was sold.

PAY TV INTEREST GROWS

With Pay TV in Hartford, Connecticut now working under a green light, numerous CATV industry personalities have made themselves heard on pay tv in particular and Hartford in general.

Among these was Irving B. Kahn, President of TelePrompter Corporation. Kahn hailed the U.S. Court of Appeals decision, upholding authorization of pay tv experiments in Hartford, as an important step toward broadening the scope of tv.

The court decision upheld the authority of the FCC to permit toll tv tests by Hartford Phonevision Company, a subsidiary of RKO General, Inc. and the Zenith Radio Corporation.

Kahn, whose company plans to begin testing a "participation tv system" of its own, soon, said:

"All of us who believe that subscription television is not only inevitable but desirable because it will improve the scope and quality of programming are pleased that this roadblock has been removed. It is in the public interest to test thoroughly the feasibility of all pay TV systems."

TelePrompter's system of pay-tv, explained Kahn, is designed to supplement rather than replace existing over the air free television. To this end, he said, TPT is investing heavily in the development of a versatile system that embodies actual audience participation.

Introducing . . . VIKINGS ALL NEW STRIP COPPER SHIELD

"FOR THE HIGHEST ACHIEVEMENT IN QUALITY"

- IMPROVED RADIATION CHARACTERISTICS
- IMPROVED ATTENUATION
- IMPROVED IMPEDENCE UNIFORMITY
- SAME O.D. ON SINGLE & DOUBLE SHIELDED TYPE CABLES
- USES STANDARD SIZE PRESSURE TAPS
- WEIGHT REDUCTION BY 20 TO 40%

WITH NEW
STRIP COPPER SHIELD

LOW LOSS
FULLY FOAM DIELECTRIC



ALL NEW SUPERIOR STRIP BRAID CO-AXIAL CABLE

SWEPT AND THOROUGHLY TESTED
NON-CONTAMINATING JACKET

VK11 SINGLE SHIELDED & SINGLE JACKETED
VKD11 DOUBLE SHIELDED & SINGLE JACKETED
VK108 SINGLE SHIELDED & SINGLE JACKETED
VKD108 DOUBLE SHIELDED & SINGLE JACKETED
VK100 SINGLE SHIELDED & SINGLE JACKETED
VKD100 DOUBLE SHIELDED & SINGLE JACKETED

TYPE	O. D. (NOM.) Inner Cond.	O. D. (NOM.) Dielectric	O. D. (NOM.) Shield	O. D. (NOM.) 2nd Shield	O. D. (NOM.) Jacket	Attenuation Channel 6 (db/100 ft.)	Attenuation Channel 13 (db/100 ft.)	Shipping Weight Lbs./M Feet
VK11	.064	.285	.296	—	.407	1.31	2.2	64
VKD11	.064	.285	.296	.307	.407	1.31	2.2	73
VK108	.081	.373	.389	—	.460	1.01	1.6	89
VKD108	.081	.373	.389	.400	.460	1.01	1.6	101
VK100	.114	.525	.536	—	.632	0.77	1.3	147
VKD100	.114	.525	.536	.547	.632	0.77	1.3	167

CALL US COLLECT

FOR SPECIAL LOW QUANTITY
PRICES ON ALL OUR ITEMS AND
TO DISCUSS YOUR SPECIAL NEEDS

New York, N.Y.
Whitehall
3-5793

Hoboken, N.J.
Oldfield
6-2020

VIKING CABLE COMPANY

100 HOBOKEN STREET • HOBOKEN, NEW JERSEY

MANUFACTURERS OF COAXIAL CABLE
AND PRODUCTS FOR THE COMMUNITY TV INDUSTRY

CATV REFLECTIONS—Continued from page 21

to the customer is to be free of disturbing echoes, particular attention should be paid to the possible sources of reflections in the branchings, taps, amplifiers and other components in the distribution lines. This subject will be treated in detail next month.

UHF TEST—Continued from page 19

Sandwich, staff director of the Consumer Products division of the ETA, called attention to the test during testimony recently before the Senate Commerce Subcommittee on Communications. "It is not inconceivable," said Mr. Sandwich, "that UHF will be found impractical in New York."

And so the controversy goes on.

MAN IN EUROPE—Continued from page 18

on a picture tube as a nice solid signal at C1 plus an echo caused by the C1 signal arriving a little later (could be earlier) via circuit C2. The result is phase distortion of the first order, and this could well be aggravated by some of C1 vision signal getting into the combining pad through other circuits as well.

Phase distortion on sound does not matter much on our AM system, but could be troublesome later when we change over to FM.

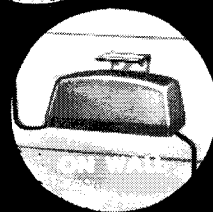
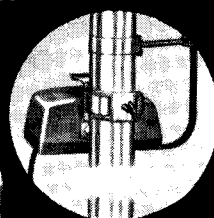
A lot of work has been done to kill spurious AGC amplifier responses and to endow each amplifier with a very fast cutoff outside the passband without introducing ringing, and a properly engineered system of the nature described has very much to commend it.

NEXT BEST THING TO THE
WINEGARD ELECTRONIC
POWERTRON TV ANTENNA

NEW TRANSISTOR TV-FM WINEGARD TENNA- BOOST

MOUNTS ON ANY ANTENNA

MOUNTS ON
ANTENNA



Model
MA-300

only **\$34⁹⁵** LIST

INSTALL IT... FORGET IT!

ALL ELECTRIC, ALL-AC POWER SUPPLY costs less than 27c a year to operate. Many exclusive features.

No costly, nuisance batteries!



Built-in two set
coupler.



Exclusive Gain
Control Switch



AC outlet on
power supply.

19 DB GAIN! CUTS SNOW...BOOSTS SIGNAL!

Now you can make any TV or FM antenna work better by magnifying signals with the new Winegard transistor Tenna-Boost.

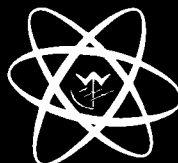
Tenna-Boost has up to 19 DB gain, no peaks and valleys. Ultra low noise. Linear frequency response. VSWR input better than 1.5:1 across all frequencies. Output VSWR 1.8:1 or better. This fine frequency response plus the very low VSWR make Tenna-Boost excellent for color.

Winegard's exclusive input band-pass filter eliminates interference from citizen's band, Hams, garage door openers, etc. Only TV and FM signals are amplified.

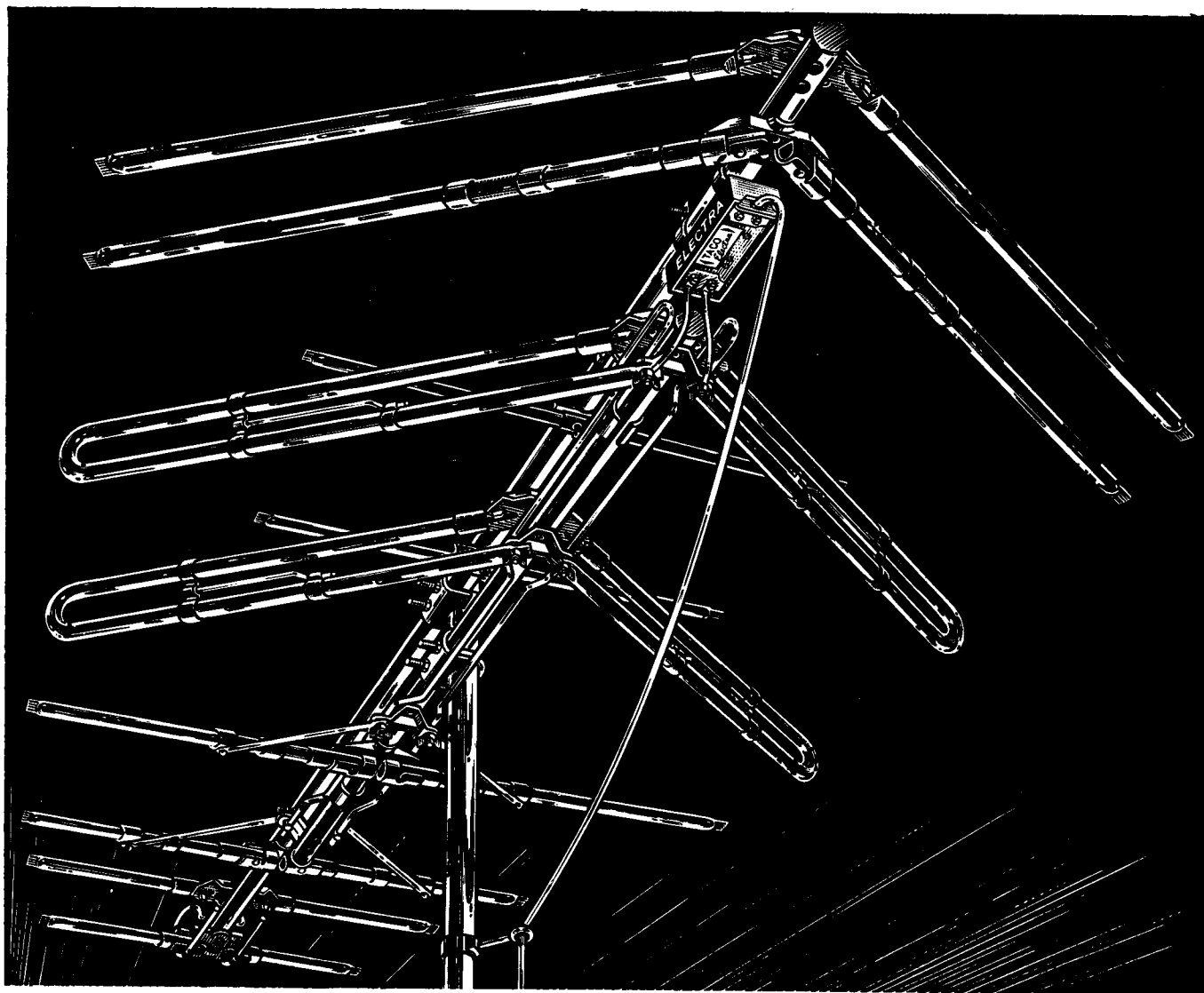
All metal parts are anodized, irradiated or stainless steel. Completely weather-proof, trouble-free. Install it... forget it.

There's a big difference in antenna amplifiers! Ask your distributor or write for technical bulletin.

FOR THE ULTIMATE IN
TV RECEPTION



Winegard



H O T T E S T

Servicemen and distributors everywhere are talking about the hottest-performing electronic antenna around—the TACO T-BIRD ELECTRA.

And you know what started them talking ... color TV. Color reception is the ultimate test of an antenna today, and here the T-BIRD ELECTRA's superior design separates the men from the boys. No friction noise, no signal flutter, a rifle-sharp forward lobe, flat response on all channels—and the best transistor preamplifier in the business (Jerrold-designed) . . . a few of the reasons why T-BIRD ELECTRAS (model for model) are *the world's most powerful electronic antennas*. Every element is extra rugged and put there to *work*, not just look pretty.

Only TACO, of all leading TV antenna manufacturers, has deep experience in designing satellite-tracking and defense antennas, as well as the best electronic know-how in the business. It's this combination that's making T-BIRD ELECTRA the hottest antenna news today. Add to this the new promotional concept that TACO offers you, and you have a line that can't be beat. Hot tip: GO TACO.

Shown above: T-BIRD ELECTRA Model G-990-8, list price \$107.20. Other T-BIRD ELECTRAS as low as \$78.80. Unpowered T-BIRD antennas list from \$28.30 to \$65.05.

TACO T-BIRD ELECTRA

WORLD'S MOST POWERFUL ELECTRONIC TV/FM ANTENNA

TECHNICAL APPLIANCE CORPORATION, Dept. JTD-39, Sherburne, N.Y.

A Subsidiary of Jerrold Electronics Corporation

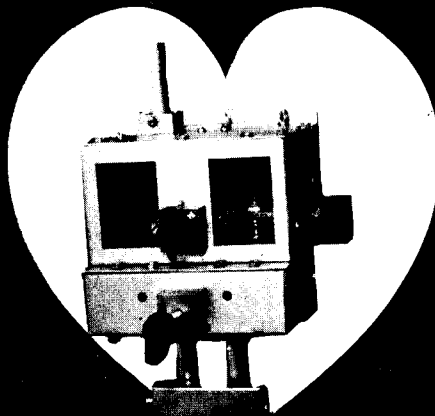
In Canada: Jerrold Electronics (Canada) Ltd., 50 Wingold Ave., Toronto • Export: Joseph Plasencia, Inc., 401 Broadway, New York 13, N.Y.

**"LOOK,
NO
CAVITIES"**

in the all-new

EMCEE

100 W UHF TRANSLATOR



FIRST PUBLIC SHOWING
NAB CONVENTION
HILTON HOTEL, CHICAGO

EMCEE

ELECTRONICS, **M**ISSILES AND **C**OMMUNICATIONS, INC.

262 East Third Street • Mount Vernon, New York • MO 8-3012

**only one of many features*

Electronics, Missiles & Communications, Inc.

262 east third street • mount vernon, new york

Gentlemen:

Please rush detailed specifications of the all-new EMCEE Model HTU-100 UHF Translator just released.

NAME _____

ADDRESS _____ CITY _____ STATE _____